Chapter 11

The Head and Neck

Chapter Objectives

- Head injuries from blunt trauma and penetrating missiles are associated with high mortality and severe disability. Headaches are usually caused by nonserious conditions such as sinusitis or neuralgia; however, they can represent the earliest manifestations of a life-threatening disease.
- Facial, scalp, and mouth injuries are commonly encountered in practice and vary in seriousness from a small skin laceration to major maxillofacial trauma. Even an untreated boil on the side of the nose can be life-threatening. Facial paralysis and unequal pupils may indicate the existence of a serious neurologic deficit.
- Many vital structures are present in the neck. Injuries or pressure on the larynx or trachea can compromise the airway. Swellings can indicate the existence of a tumor of the thyroid gland or the presence of a malignant secondary lesion in a lymph node.
- Clearly, many signs and symptoms related to the region of the head and neck are determined by the anatomic arrangement of the various structures. This chapter discusses the basic anatomy of this complicated region and highlights the clinical relevance of the structures considered. It specifically excludes consideration of the detailed structure of the brain, which is covered in a neurology text.

Basic Anatomy

The head and neck region of the body contains many important structures compressed into a relatively small area.

The Head

The head is formed mainly by the skull with the brain and its covering meninges enclosed in the cranial cavity. The special senses, the eye and

the ear, lie within the skull bones or in the cavities bounded by them. The brain gives rise to 12 pairs of cranial nerves, which leave the brain and pass through foramina and fissures in the skull. All the cranial nerves are distributed to structures in the head and neck, except the 10th, which also supplies structures in the chest and abdomen.

Bones of the Skull

Composition

The skull is composed of several separate bones united at immobile joints called sutures. The connective tissue between the bones is called a sutural ligament. The mandible is an exception to this rule, for it is united to the skull by the mobile temporomandibular joint.

The bones of the skull can be divided into those of the cranium and those of the face. The vault is the upper part of the cranium, and the base of the skull is the lowest part of the cranium.

The skull bones are made up of external and internal tables of compact bone separated by a layer of spongy bone called the diploë. The internal table is thinner and more brittle than the external table. The bones are covered on the outer and inner surfaces with periosteum.

The cranium consists of the following bones, two of which are paired:

- Frontal bone: 1
- Parietal bones: 2
- Occipital bone: 1
- Temporal bones: 2
- Sphenoid bone: 1
- Ethmoid bone: 1

The facial bones consist of the following, two of which are single:

- Zygomatic bones: 2
- Maxillae: 2
- Nasal bones: 2

- Lacrimal bones: 2
- Vomer: 1
- Palatine bones: 2
- Inferior conchae: 2
- Mandible: 1

External Views of the Skull

Anterior View of the Skull

The **frontal bone**, or forehead bone, curves downward to make the upper margins of the orbits. The superciliary arches can be seen on either side, and the supraorbital notch, or foramen, can be recognized. Medially, the frontal bone articulates with the frontal processes of the maxillae and with the nasal bones. Laterally, the frontal bone articulates with the zygomatic bone.

The orbital margins are bounded by the frontal bone superiorly, the zygomatic bone laterally, the maxilla inferiorly, and the processes of the maxilla and frontal bone medially.

Within the frontal bone, just above the orbital margins, are two hollow spaces lined with mucous membrane called the frontal air sinuses. These communicate with the nose and serve as voice resonators.

The two **nasal bones** form the bridge of the nose. Their lower borders, with the maxillae, make the anterior nasal aperture. The nasal cavity is divided into two by the bony nasal septum, which is largely formed by the vomer. The superior and middle conchae are shelves of bone that project into the nasal cavity from the ethmoid on each side; the inferior conchae are separate bones.

The two **maxillae** form the upper jaw, the anterior part of the hard palate, part of the lateral walls of the nasal cavities, and part of the floors of the orbital cavities. The two bones meet in the midline at the intermaxillary suture and form the lower margin of the nasal aperture. Below the orbit, the maxilla is perforated by the infraorbital foramen. The alveolar process projects downward and, together with the fellow of

the opposite side, forms the alveolar arch, which carries the upper teeth. Within each maxilla is a large, pyramid-shaped cavity lined with mucous membrane called the maxillary sinus. This communicates with the nasal cavity and serves as a voice resonator.

The **zygomatic** bone forms the prominence of the cheek and part of the lateral wall and floor of the orbital cavity. Medially, it articulates with the maxilla and laterally it articulates with the zygomatic process of the temporal bone to form the zygomatic arch. The zygomatic bone is perforated by two foramina for the zygomaticofacial and zygomaticotemporal nerves.

The mandible, or lower jaw, consists of a horizontal body and two vertical rami.

Lateral View of the Skull

The frontal bone forms the anterior part of the side of the skull and articulates with the parietal bone at the coronal suture.

The parietal bones form the sides and roof of the cranium and articulate with each other in the midline at the sagittal suture. They articulate with the occipital bone behind, at the lambdoid suture.

The skull is completed at the side by the squamous part of the occipital bone; parts of the temporal bone, namely, the squamous, tympanic, mastoid process, styloid process, and zygomatic process; and the greater wing of the sphenoid. Note the position of the external auditory meatus. The ramus and body of the mandible lie inferiorly.

Note that the thinnest part of the lateral wall of the skull is where the anteroinferior corner of the parietal bone articulates with the greater wing of the sphenoid; this point is referred to as the pterion.

Clinically, the pterion is an important area because it overlies the anterior division of the middle meningeal artery and vein.

Identify the superior and inferior temporal lines, which begin as a single line from the posterior margin of the zygomatic process of the

frontal bone and diverge as they arch backward. The temporal fossa lies below the inferior temporal line.

The infratemporal fossa lies below the infratemporal crest on the greater wing of the sphenoid. The pterygomaxillary fissure is a vertical fissure that lies within the fossa between the pterygoid process of the sphenoid bone and back of the maxilla. It leads medially into the pterygopalatine fossa.

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.

The pterygopalatine fossa is a small space behind and below the orbital cavity. It communicates laterally with the infratemporal fossa through the pterygomaxillary fissure, medially with the nasal cavity through the sphenopalatine foramen, superiorly with the skull through the foramen rotundum, and anteriorly with the orbit through the inferior orbital fissure.

Posterior View of the Skull

The posterior parts of the two parietal bones with the intervening sagittal suture are seen above. Below, the parietal bones articulate with the squamous part of the occipital bone at the lambdoid suture. On each side the occipital bone articulates with the temporal bone. In the midline of the occipital bone is a roughened elevation called the external occipital protuberance, which gives attachment to muscles and the ligamentum nuchae. On either side of the protuberance the superior nuchal lines extend laterally toward the temporal bone.

Superior View of the Skull

Anteriorly, the frontal bone articulates with the two parietal bones at the coronal suture. Occasionally, the two halves of the frontal bone fail to fuse, leaving a midline metopic suture. Behind, the two parietal bones articulate in the midline at the sagittal suture.

Inferior View of the Skull

If the mandible is discarded, the anterior part of this aspect of the skull is seen to be formed by the hard palate.

The palatal processes of the maxillae and the horizontal plates of the palatine bones can be identified. In the midline anteriorly is the incisive fossa and foramen. Posterolaterally are the greater and lesser palatine foramina.

Above the posterior edge of the hard palate are the choanae (posterior nasal apertures). These 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. The inferior end of the medial pterygoid plate is prolonged as a curved spike 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.

Behind the spine of the sphenoid, in the interval between the greater wing of the sphenoid and the petrous part of the temporal bone, is a groove for the cartilaginous part of the auditory tube. The opening of the bony part of the tube can be identified.

The mandibular fossa of the temporal bone and the articular tubercle form the upper articular surfaces for the temporomandibular joint. Separating the mandibular fossa from the tympanic plate posteriorly is the squamotympanic fissure, through the medial end of which the chorda tympani nerve exits from the tympanic cavity.

The styloid process of the temporal bone projects downward and forward from its inferior aspect. The opening of the carotid canal can be seen on the inferior surface of the petrous part of the temporal bone.

The medial end of the petrous part of the temporal bone is irregular and, together with the basilar part of the occipital bone and the greater

wing of the sphenoid, forms the foramen lacerum. During life, the foramen lacerum is closed with fibrous tissue, and only a few small vessels pass through this foramen from the cavity of the skull to the exterior.

The tympanic plate, which forms part of the temporal bone, is C shaped on section and forms the bony part of the external auditory meatus. While examining this region, identify the suprameatal crest on the lateral surface of the squamous part of the temporal bone, the suprameatal triangle, and the suprameatal spine.

In the interval between the styloid and mastoid processes, the stylomastoid foramen can be seen. Medial to the styloid process, the petrous part of the temporal bone has a deep notch, which, together with a shallower notch on the occipital bone, forms the jugular foramen.

Behind the posterior apertures of the nose and in front of the foramen magnum are the sphenoid bone and the basilar part of the occipital bone. The pharyngeal tubercle is a small prominence on the undersurface of the basilar part of the occipital bone in the midline.

The occipital condyles should be identified; they articulate with the superior aspect of the lateral mass of the first cervical vertebra, the atlas. Superior to the occipital condyle is the hypoglossal canal for transmission of the hypoglossal nerve.

Posterior to the foramen magnum in the midline is the external occipital protuberance. The superior nuchal lines should be identified as they curve laterally on each side.

The Cranial Cavity

The cranial cavity contains the brain and its surrounding meninges, portions of the cranial nerves, arteries, veins, and venous sinuses.

Vault of the Skull

The internal surface of the vault shows the coronal, sagittal, and lambdoid sutures. In the midline is a shallow sagittal groove that lodges the superior sagittal sinus. On each side of the groove are several small pits, called granular pits, which lodge the lateral lacunae and arachnoid granulations. Several narrow grooves are present for the anterior and posterior divisions of the middle meningeal vessels as they pass up the side of the skull to the vault.

Base of the Skull

The interior of the base of the skull is divided into three cranial fossae: anterior, middle, and posterior. The anterior cranial fossa is separated from the middle cranial fossa by the lesser wing of the sphenoid, and the middle cranial fossa is separated from the posterior cranial fossa by the petrous part of the temporal bone.

Anterior Cranial Fossa

The anterior cranial fossa lodges the frontal lobes of the cerebral hemispheres. It is bounded anteriorly by the inner surface of the frontal bone, and in the midline is a crest for the attachment of the falx cerebri. Its posterior boundary is the sharp lesser wing of the sphenoid, which articulates laterally with the frontal bone and meets the anteroinferior angle of the parietal bone, or the pterion. The medial end of the lesser wing of the sphenoid forms the anterior clinoid process on each side, which gives attachment to the tentorium cerebelli. The median part of the anterior cranial fossa is limited posteriorly by the groove for the optic chiasma.

The floor of the fossa is formed by the ridged orbital plates of the frontal bone laterally and by the cribriform plate of the ethmoid medially. The crista galli is a sharp upward projection of the ethmoid bone in the midline for the attachment of the falx cerebri. Alongside the crista galli is a narrow slit in the cribriform plate for the passage of the

anterior ethmoidal nerve into the nasal cavity. The upper surface of the cribriform plate supports the olfactory bulbs, and the small perforations in the cribriform plate are for the olfactory nerves.

Middle Cranial Fossa

The middle cranial fossa consists of a small median part and expanded lateral parts. The median raised part is formed by the body of the sphenoid, and the expanded lateral parts form concavities on either side, which lodge the temporal lobes of the cerebral hemispheres.

It is bounded anteriorly by the lesser wings of the sphenoid and posteriorly by the superior borders of the petrous parts of the temporal bones. Laterally lie the squamous parts of the temporal bones, the greater wings of the sphenoid, and the parietal bones.

The floor of each lateral part of the middle cranial fossa is formed by the greater wing of the sphenoid and the squamous and petrous parts of the temporal bone.

The sphenoid bone resembles a bat having a centrally placed body with greater and lesser wings that are outstretched on each side. The body of the sphenoid contains the sphenoid air sinuses, which are lined with mucous membrane and communicate with the nasal cavity; they serve as voice resonators.

Anteriorly, the optic canal transmits the optic nerve and the ophthalmic artery, a branch of the internal carotid artery, to the orbit. The superior orbital fissure, which is a slitlike opening between the lesser and greater wings of the sphenoid, transmits the lacrimal, frontal, trochlear, oculomotor, nasociliary, and abducent nerves, together with the superior ophthalmic vein. The sphenoparietal venous sinus runs medially along the posterior border of the lesser wing of the sphenoid and drains into the cavernous sinus.

The foramen rotundum, which is situated behind the medial end of the superior orbital fissure, perforates the greater wing of the sphenoid

and transmits the maxillary nerve from the trigeminal ganglion to the pterygopalatine fossa.

The foramen ovale lies posterolateral to the foramen rotundum. It perforates the greater wing of the sphenoid and transmits the large sensory root and small motor root of the mandibular nerve to the infratemporal fossa; the lesser petrosal nerve also passes through it.

The small foramen spinosum lies posterolateral to the foramen ovale and also perforates the greater wing of the sphenoid. The foramen transmits the middle meningeal artery from the infratemporal fossa into the cranial cavity. The artery then runs forward and laterally in a groove on the upper surface of the squamous part of the temporal bone and the greater wing of the sphenoid. After a short distance, the artery divides into anterior and posterior branches. The anterior branch passes forward and upward to the anteroinferior angle of the parietal bone. Here, the bone is deeply grooved or tunneled by the artery for a short distance before it runs backward and upward on the parietal bone. It is at this site that the artery may be damaged after a blow to the side of the head. The posterior branch passes backward and upward across the squamous part of the temporal bone to reach the parietal bone.

The large and irregularly shaped foramen lacerum lies between the apex of the petrous part of the temporal bone and the sphenoid bone. The inferior opening of the foramen lacerum in life is filled by cartilage and fibrous tissue, and only small blood vessels pass through this tissue from the cranial cavity to the neck.

The carotid canal opens into the side of the foramen lacerum above the closed inferior opening. The internal carotid artery enters the foramen through the carotid canal and immediately turns upward to reach the side of the body of the sphenoid bone. Here, the artery turns forward in the cavernous sinus to reach the region of the anterior clinoid process. At this point, the internal carotid artery turns vertically upward, medial to the anterior clinoid process, and emerges from the cavernous sinus.

Lateral to the foramen lacerum is an impression on the apex of the petrous part of the temporal bone for the trigeminal ganglion. On the anterior surface of the petrous bone are two grooves for nerves; the largest medial groove is for the greater petrosal nerve, a branch of the facial nerve; the smaller lateral groove is for the lesser petrosal nerve, a branch of the tympanic plexus. The greater petrosal nerve enters the foramen lacerum deep to the trigeminal ganglion and joins the deep petrosal nerve (sympathetic fibers from around the internal carotid artery), to form the nerve of the pterygoid canal. The lesser petrosal nerve passes forward to the foramen ovale.

The abducent nerve bends sharply forward across the apex of the petrous bone, medial to the trigeminal ganglion. Here, it leaves the posterior cranial fossa and enters the cavernous sinus.

The arcuate eminence is a rounded eminence found on the anterior surface of the petrous bone and is caused by the underlying superior semicircular canal.

The tegmen tympani, a thin plate of bone, is a forward extension of the petrous part of the temporal bone and adjoins the squamous part of the bone. From behind forward, it forms the roof of the mastoid antrum, the tympanic cavity, and the auditory tube. This thin plate of bone is the only major barrier that separates infection in the tympanic cavity from the temporal lobe of the cerebral hemisphere.

The median part of the middle cranial fossa is formed by the body of the sphenoid bone. In front is the sulcus chiasmatis, which is related to the optic chiasma and leads laterally to the optic canal on each side. Posterior to the sulcus is an elevation, the tuberculum sellae. Behind the elevation is a deep depression, the sella turcica, which lodges the pituitary gland. The sella turcica is bounded posteriorly by a square plate of bone called the dorsum sellae. The superior angles of the dorsum sellae have two tubercles, called the posterior clinoid processes, which give attachment to the fixed margin of the tentorium cerebelli.

The cavernous sinus is directly related to the side of the body of the sphenoid. It carries in its lateral wall the third and fourth cranial nerves and the ophthalmic and maxillary divisions of the fifth cranial nerve. The internal carotid artery and the sixth cranial nerve pass forward through the sinus.

Posterior Cranial Fossa

The posterior cranial fossa is deep and lodges the parts of the hindbrain, namely, the cerebellum, pons, and medulla oblongata. Anteriorly the fossa is bounded by the superior border of the petrous part of the temporal bone, and posteriorly it is bounded 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.

The roof of the fossa is formed by a fold of dura, the tentorium cerebelli, which intervenes between the cerebellum below and the occipital lobes of the cerebral hemispheres above.

The foramen magnum occupies the central area of the floor and transmits the medulla oblongata and its surrounding meninges, the ascending spinal parts of the accessory nerves, and the two vertebral arteries.

The hypoglossal canal is situated above the anterolateral boundary of the foramen magnum and transmits the hypoglossal nerve.

The jugular foramen lies between the lower border of the petrous part of the temporal bone and the condylar part of the occipital bone. It transmits the following structures from before backward: the inferior petrosal sinus; the 9th, 10th, and 11th cranial nerves; and the large sigmoid sinus. The inferior petrosal sinus descends in the groove on the lower border of the petrous part of the temporal bone to reach the foramen. The sigmoid sinus turns down through the foramen to become the internal jugular vein.

The internal acoustic meatus pierces the posterior surface of the petrous part of the temporal bone. It transmits the vestibulocochlear nerve and the motor and sensory roots of the facial nerve.

The internal occipital crest runs upward in the midline posteriorly from the foramen magnum to the internal occipital protuberance; to it is attached the small falx cerebelli over the occipital sinus.

On each side of the internal occipital protuberance is a wide groove for the transverse sinus. This groove sweeps around on either side, on the internal surface of the occipital bone, to reach the posteroinferior angle or corner of the parietal bone. The groove now passes onto the mastoid part of the temporal bone, and here the transverse sinus becomes the sigmoid sinus. The superior petrosal sinus runs backward along the upper border of the petrous bone in a narrow groove and drains into the sigmoid sinus. As the sigmoid sinus descends to the jugular foramen, it deeply grooves the back of the petrous bone and the mastoid part of the temporal bone. Here, it lies directly posterior to the mastoid antrum.

Summary of the More Important Openings in the Base of the Skull and the Structures That Pass Through Them

Opening in Skull	Bone of Skull	Structures Transmitted
Anterior Cranial Fossa		
Perforations in cribriform plate	Ethmoid	Olfactory nerves
Middle Cranial Fossa		
Optic canal	Lesser wing of sphenoid	Optic nerve, ophthalmic artery
Superior orbital	Between lesser and	Lacrimal, frontal, trochlear,

fissure	greater wings of sphenoid	oculomotor, nasociliary, and abducent nerves; superior ophthalmic vein
Foramen rotundum	Greater wing of sphenoid	Maxillary division of the trigeminal nerve
Foramen ovale	Greater wing of sphenoid	Mandibular division of the trigeminal nerve, lesser petrosal nerve
Foramen spinosum	Greater wing of sphenoid	Middle meningeal artery
Foramen lacerum	Between petrous part of temporal and sphenoid	Internal carotid artery

Posterior Cranial Fossa

Foramen magnum	Occipital	Medulla oblongata, spinal part of accessory nerve, and right and left vertebral arteries
Hypoglossal canal	Occipital	Hypoglossal nerve
Jugular foramen	Between petrous part of temporal and condylar part of occipital	Glossopharyngeal, vagus, and accessory nerves; sigmoid sinus becomes internal jugular vein
Internal acoustic meatus	Petrous part of temporal	Vestibulocochlear and facial nerves

Neonatal Skull

The newborn skull, compared with the adult skull, has a disproportionately large cranium relative to the face. In childhood, the growth of the mandible, the maxillary sinuses, and the alveolar processes of the maxillae results in a great increase in length of the face.

The bones of the skull are smooth and unilaminar, there being no diploë present. Most of the skull bones are ossified at birth, but the process is incomplete, and the bones are mobile on each other, being connected by fibrous tissue or cartilage. The bones of the vault are ossified in membrane; the bones of the base are ossified in cartilage. The bones of the vault are not closely knit at sutures, as in the adult, but are separated by unossified membranous intervals called fontanelles. Clinically, the anterior and posterior fontanelles are most important and are easily examined in the midline of the vault.

The anterior fontanelle is diamond shaped and lies between the two halves of the frontal bone in front and the two parietal bones behind. The fibrous membrane forming the floor of the anterior fontanelle is replaced by bone and is closed by 18 months of age. The posterior fontanelle is triangular and lies between the two parietal bones in front and the occipital bone behind. By the end of the first year, the fontanelle is usually closed and can no longer be palpated.

The tympanic part of the temporal bone is merely a C-shaped ring at birth, compared with a C-shaped curved plate in the adult. This means that the external auditory meatus is almost entirely cartilaginous in the newborn, and the tympanic membrane is nearer the surface. Although the tympanic membrane is nearly as large as in the adult, it faces more inferiorly. During childhood the tympanic plate grows laterally, forming the bony part of the meatus, and the tympanic membrane comes to face more directly laterally.

The mastoid process is not present at birth and develops later in response to the pull of the sternocleidomastoid muscle when the child moves his or her head.

At birth, the mastoid antrum lies about 3 mm deep to the floor of the suprameatal triangle. As growth of the skull continues, the lateral bony wall thickens so that at puberty the antrum may lie as much as 15 mm from the surface.

The mandible has right and left halves at birth, united in the midline with fibrous tissue. The two halves fuse at the symphysis menti by the end of the first year.

The angle of the mandible at birth is obtuse, the head being placed level with the upper margin of the body and the coronoid process lying at a superior level to the head. It is only after eruption of the permanent teeth that the angle of the mandible assumes the adult shape and the head and neck grow so that the head comes to lie higher than the coronoid process.

In old age, the size of the mandible is reduced when the teeth are lost. As the alveolar part of the bone becomes smaller, the ramus becomes oblique in position so that the head is bent posteriorly.

The Meninges

The brain in the skull is surrounded by three protective membranes, or meninges: the dura mater, the arachnoid mater, and the pia mater. (The spinal cord in the vertebral column is also surrounded by three meninges.

Dura Mater of the Brain

The dura mater is conventionally described as two layers: the endosteal layer and the meningeal layer. These are closely united except along certain lines, where they separate to form venous sinuses.

The endosteal layer is nothing more than the ordinary periosteum covering the inner surface of the skull bones. It does not extend through the foramen magnum to become continuous with the dura mater of the spinal cord. Around the margins of all the foramina in the skull it becomes continuous with the periosteum on the outside of the skull bones. At the sutures it is continuous with the sutural ligaments. It is most strongly adherent to the bones over the base of the skull.

The meningeal layer is the dura mater proper. It is a dense, strong, fibrous membrane covering the brain and is continuous through the foramen magnum with the dura mater of the spinal cord. It provides tubular sheaths for the cranial nerves as the latter pass through the foramina in the skull. Outside the skull the sheaths fuse with the epineurium of the nerves.

The meningeal layer sends inward four septa that divide the cranial cavity into freely communicating spaces lodging the subdivisions of the brain. The function of these septa is to restrict the rotatory displacement of the brain.

The **falx cerebri** is a sickle-shaped fold of dura mater that lies in the midline between the two cerebral hemispheres. Its narrow end in front is attached to the internal frontal crest and the crista galli. Its broad posterior part blends in the midline with the upper surface of the tentorium cerebelli. The superior sagittal sinus runs in its upper fixed margin, the inferior sagittal sinus runs in its lower concave free margin, and the straight sinus runs along its attachment to the tentorium cerebelli.

The **tentorium cerebelli** is a crescent-shaped fold of dura mater that roofs over the posterior cranial fossa. It covers the upper surface of the cerebellum and supports the occipital lobes of the cerebral hemispheres. In front is a gap, the tentorial notch, for the passage of the midbrain, thus producing an inner free border and an outer attached or fixed border. The fixed border is attached to the posterior clinoid processes, the superior borders of the petrous bones, and the margins of the grooves for the transverse sinuses on the occipital bone. The free border runs forward at its two ends, crosses the attached border, and is affixed to the anterior clinoid process on each side. At the point where the two borders cross, the third and fourth cranial nerves pass forward to enter the lateral wall of the cavernous sinus.

Close to the apex of the petrous part of the temporal bone, the lower layer of the tentorium is pouched forward beneath the superior petrosal sinus to form a recess for the trigeminal nerve and the trigeminal ganglion.

The falx cerebri and the falx cerebelli are attached to the upper and lower surfaces of the tentorium, respectively. The straight sinus runs along its attachment to the falx cerebri, the superior petrosal sinus along its attachment to the petrous bone, and the transverse sinus along its attachment to the occipital bone.

The **falx cerebelli** is a small, sickle-shaped fold of dura mater that is attached to the internal occipital crest and projects forward between the two cerebellar hemispheres. Its posterior fixed margin contains the occipital sinus.

The **diaphragma sellae** is a small circular fold of dura mater that forms the roof for the sella turcica. A small opening in its center allows passage of the stalk of the pituitary gland.

Dural Nerve Supply

Branches of the trigeminal, vagus, and first three cervical nerves and branches from the sympathetic system pass to the dura.

Numerous sensory endings are in the dura. The dura is sensitive to stretching, which produces the sensation of headache. Stimulation of the sensory endings of the trigeminal nerve above the level of the tentorium cerebelli produces referred pain to an area of skin on the same side of the head. Stimulation of the dural endings below the level of the tentorium produces referred pain to the back of the neck and back of the scalp along the distribution of the greater occipital nerve.

Dural Arterial Supply

Numerous arteries supply the dura mater from the internal carotid, maxillary, ascending pharyngeal, occipital, and vertebral arteries. From a clinical standpoint, the most important is the middle meningeal artery, which is commonly damaged in head injuries.

The **middle meningeal artery** arises from the maxillary artery in the infratemporal fossa. It enters the cranial cavity and runs forward and laterally in a groove on the upper surface of the squamous part of the temporal bone. To enter the cranial cavity, it passes through the foramen spinosum to lie between the meningeal and endosteal layers of dura. Its further course in the middle cranial fossa is described on page 750. The anterior (frontal) branch deeply grooves or tunnels the anteroinferior angle of the parietal bone, and its course corresponds roughly to the line of the underlying precentral gyrus of the brain. The posterior (parietal) branch curves backward and supplies the posterior part of the dura mater.

Dural Venous Drainage

The meningeal veins lie in the endosteal layer of dura. The middle meningeal vein follows the branches of the middle meningeal artery and drains into the pterygoid venous plexus or the sphenoparietal sinus. The veins lie lateral to the arteries.

Arachnoid Mater of the Brain

The arachnoid mater is a delicate, impermeable membrane covering the brain and lying between the pia mater internally and the dura mater externally. It is separated from the dura by a potential space, the subdural space, and from the pia by the subarachnoid space, which is filled with cerebrospinal fluid.

The arachnoid bridges over the sulci on the surface of the brain, and in certain situations the arachnoid and pia are widely separated to form the subarachnoid cisternae.

In certain areas the arachnoid projects into the venous sinuses to form arachnoid villi. The arachnoid villi are most numerous along the superior sagittal sinus. Aggregations of arachnoid villi are referred to as arachnoid granulations. Arachnoid villi serve as sites where the cerebrospinal fluid diffuses into the bloodstream.

It is important to remember that structures passing to and from the brain to the skull or its foramina must pass through the subarachnoid space. All the cerebral arteries and veins lie in the space, as do the cranial nerves. The arachnoid fuses with the epineurium of the nerves at their point of exit from the skull. In the case of the optic nerve, the arachnoid forms a sheath for the nerve that extends into the orbital cavity through the optic canal and fuses with the sclera of the eyeball. Thus, the subarachnoid space extends around the optic nerve as far as the eyeball

The cerebrospinal fluid is produced by the choroid plexuses within the lateral, third, and fourth ventricles of the brain. It escapes from the ventricular system of the brain through the three foramina in the roof of the fourth ventricle and so enters the subarachnoid space. It now circulates both upward over the surfaces of the cerebral hemispheres and downward around the spinal cord. The spinal subarachnoid space extends down as far as the second sacral vertebra. Eventually, the fluid enters the bloodstream by passing into the arachnoid villi and diffusing through their walls.

In addition to removing waste products associated with neuronal activity, the cerebrospinal fluid provides a fluid medium in which the brain floats. This mechanism effectively protects the brain from trauma.

Pia Mater of the Brain

The pia mater is a vascular membrane that closely invests the brain, covering the gyri and descending into the deepest sulci. It extends over

the cranial nerves and fuses with their epineurium. The cerebral arteries entering the substance of the brain carry a sheath of pia with them.

The Venous Blood Sinuses

The venous sinuses of the cranial cavity are blood-filled spaces situated between the layers of the dura mater; they are lined by endothelium. Their walls are thick and composed of fibrous tissue; they have no muscular tissue. The sinuses have no valves. They receive tributaries from the brain, the diplo of the skull, the orbit, and the internal ear.

The **superior sagittal sinus** lies in the upper fixed border of the falx cerebri. It runs backward and becomes continuous with the right transverse sinus. The sinus communicates on each side with the venous lacunae. Numerous arachnoid villi and granulations project into the lacunae. The superior sagittal sinus receives the superior cerebral veins.

The **inferior sagittal sinus** lies in the free lower margin of the falx cerebri. It runs backward and joins the great cerebral vein to form the straight sinus. It receives cerebral veins from the medial surface of the cerebral hemisphere.

The **straight sinus** lies at the junction of the falx cerebri with the tentorium cerebelli. Formed by the union of the inferior sagittal sinus with the great cerebral vein, it drains into the left transverse sinus.

The **right transverse sinus** begins as a continuation of the superior sagittal sinus; the **left transverse sinus** is usually a continuation of the straight sinus. Each sinus lies in the lateral attached margin of the tentorium cerebelli, and they end on each side by becoming the sigmoid sinus.

The **sigmoid sinuses** are a direct continuation of the transverse sinuses. Each sinus turns downward behind the mastoid antrum of the temporal bone and then leaves the skull through the jugular foramen to become the internal jugular vein.

The occipital sinus lies in the attached margin of the falx cerebelli. It communicates with the vertebral veins through the foramen magnum and the transverse sinuses.

Each **cavernous sinus** lies on the lateral side of the body of the sphenoid bone. Anteriorly, the sinus receives the inferior ophthalmic vein and the central vein of the retina. The sinus drains posteriorly into the transverse sinus through the superior petrosal sinus. Intercavernous sinuses connect the two cavernous sinuses through the sella turcica.

Important Structures Associated With the Cavernous Sinuses

- The internal carotid artery and the sixth cranial nerve, which travel through it.
- In the lateral wall, the third and fourth cranial nerves, and the ophthalmic and maxillary divisions of the fifth cranial nerve.
- The pituitary gland, which lies medially in the sella turcica.
- The veins of the face, which are connected with the cavernous sinus via the facial vein and inferior ophthalmic vein, and are an important route for the spread of infection from the face.
- The superior and inferior petrosal sinuses, which run along the upper and lower borders of the petrous part of the temporal bone.

Pituitary Gland (Hypophysis Cerebri)

The pituitary gland is a small, oval structure attached to the undersurface of the brain by the infundibulum. The gland is well protected by virtue of its location in the sella turcica of the sphenoid bone.

The Mandible

The mandible or lower jaw is the largest and strongest bone of the face, and it articulates with the skull at the temporomandibular joint.

The mandible consists of a horseshoe-shaped body and a pair of rami. The body of the mandible meets the ramus on each side at the angle of the mandible.

The body of the mandible, on its external surface in the midline, has a faint ridge indicating the line of fusion of the two halves during development at the symphysis menti. The mental foramen can be seen below the second premolar tooth; it transmits the terminal branches of the inferior alveolar nerve and vessels.

On the medial surface of the body of the mandible in the median plane are seen the mental spines; these give origin to the genioglossus muscles above and the geniohyoid muscles below. The mylohyoid line can be seen as an oblique ridge that runs backward and laterally from the area of the mental spines to an area below and behind the third molar tooth. The submandibular fossa, for the superficial part of the submandibular salivary gland, lies below the posterior part of the mylohyoid line. The sublingual fossa, for the sublingual gland, lies above the anterior part of the mylohyoid line.

The upper border of the body of the mandible is called the alveolar part; in the adult it contains 16 sockets for the roots of the teeth.

The lower border of the body of the mandible is called the base. The digastric fossa is a small, roughened depression on the base, on either side of the symphysis menti. It is in these fossae that the anterior bellies of the digastric muscles are attached.

The ramus of the mandible is vertically placed and has an anterior coronoid process and a posterior condyloid process, or head; the two processes are separated by the mandibular notch.

On the lateral surface of the ramus are markings for the attachment of the masseter muscle. On the medial surface is the mandibular foramen for the inferior alveolar nerve and vessels. In front of the foramen is a projection of bone, called the lingula, for the attachment of the sphenomandibular ligament. The foramen leads into the mandibular canal, which opens on the lateral surface of the body of the mandible at

the mental foramen (see above). The incisive canal is a continuation forward of the mandibular canal beyond the mental foramen and below the incisor teeth.

The coronoid process receives on its medial surface the attachment of the temporalis muscle. Below the condyloid process, or head, is a short neck.

Temporomandibular Joint

Articulation

Articulation occurs between the articular tubercle and the anterior portion of the mandibular fossa of the temporal bone above and the head (condyloid process) of the mandible below. The articular surfaces are covered with fibrocartilage.

Type of Joint

The temporomandibular joint is synovial. The articular disc divides the joint into upper and lower cavities.

Capsule

The capsule surrounds the joint and is attached above to the articular tubercle and the margins of the mandibular fossa and below to the neck of the mandible.

Ligaments

The lateral temporomandibular ligament strengthens the lateral aspect of the capsule, and its fibers run downward and backward from the tubercle on the root of the zygoma to the lateral surface of the neck of the mandible. This ligament limits the movement of the mandible in a posterior direction and thus protects the external auditory meatus.

The sphenomandibular ligament lies on the medial side of the joint. It is a thin band that is attached above to the spine of the sphenoid bone

and below to the lingula of the mandibular foramen. It represents the remains of the first pharyngeal arch in this region.
The stylomandibular ligament lies behind and medial to the joint and some distance from it. It is merely a band of thickened deep cervical fascia that extends from the apex of the styloid process to the angle of the mandible.

The articular disc divides the joint into upper and lower cavities. It is an oval plate of fibrocartilage that is attached circumferentially to the capsule. It is also attached in front to the tendon of the lateral pterygoid muscle and by fibrous bands to the head of the mandible. These bands ensure that the disc moves forward and backward with the head of the mandible during protraction and retraction of the mandible. The upper surface of the disc is concavoconvex from before backward to fit the shape of the articular tubercle and the mandibular fossa; the lower surface is concave to fit the head of the mandible.

Synovial Membrane

This lines the capsule in the upper and lower cavities of the joint.

Nerve Supply

Auriculotemporal and masseteric branches of the mandibular nerve

Movements

The mandible can be depressed or elevated, protruded or retracted. Rotation can also occur, as in chewing. In the position of rest, the teeth of the upper and lower jaws are slightly apart. On closure of the jaws, the teeth come into contact.
Important Relations of the Temporomandibular Joint

- Anteriorly: The mandibular notch and the masseteric nerve and artery
- Posteriorly: The tympanic plate of the external auditory meatus and the glenoid process of the parotid gland

- Laterally: The parotid gland, fascia, and skin
- Medially: The maxillary artery and vein and the auriculotemporal nerve

The Scalp

Structure

The scalp consists of five layers, the first three of which are intimately bound together and move as a unit. To assist one in memorizing the names of the five layers of the scalp, use each letter of the word SCALP to denote the layer of the scalp.

- Skin, which is thick and hair bearing and contains numerous sebaceous glands
- Connective tissue beneath the skin, which is fibrofatty, the fibrous septa uniting the skin to the underlying aponeurosis of the occipitofrontalis muscle. Numerous arteries and veins are found in this layer. The arteries are branches of the external and internal carotid arteries, and a free anastomosis takes place between them.
- Aponeurosis (epicranial), which is a thin, tendinous sheet that unites the occipital and frontal bellies of the occipitofrontalis muscle. The lateral margins of the aponeurosis are attached to the temporal fascia. The subaponeurotic space is the potential space beneath the epicranial aponeurosis. It is limited in front and behind by the origins of the occipitofrontalis muscle, and it extends laterally as far as the attachment of the aponeurosis to the temporal fascia.
- Loose areolar tissue, which occupies the subaponeurotic space and loosely connects the epicranial aponeurosis to the periosteum

of the skull (the pericranium). The areolar tissue contains a few small arteries, but it also contains some important emissary veins. The emissary veins are valveless and connect the superficial veins of the scalp with the diploic veins of the skull bones and with the intracranial venous sinuses.

- Pericranium, which is the periosteum covering the outer surface of the skull bones. It is important to remember that at the sutures between individual skull bones, the periosteum on the outer surface of the bones becomes continuous with the periosteum on the inner surface of the skull bones.

Muscles of the Scalp

Occipitofrontalis

- Origin: It consists of four bellies, two occipital and two frontal, connected by an aponeurosis. Each occipital belly arises from the highest nuchal line on the occipital bone and passes forward to be attached to the aponeurosis. Each frontal belly arises from the skin and superficial fascia of the eyebrow and passes backward to be attached to the aponeurosis.
- Nerve supply: The occipital belly is supplied by the posterior auricular branch of the facial nerve; the frontal belly is supplied by the temporal branch of the facial nerve.
- Action: The first three layers of the scalp can be moved forward or backward. The frontal bellies can raise the eyebrow in expression of surprise or horror.

Sensory Nerve Supply of the Scalp

The main trunks of the sensory nerves lie in the superficial fascia. Moving laterally from the midline anteriorly, the following nerves are present:

- The **supratrochlear nerve**, a branch of the ophthalmic division of the trigeminal nerve, winds around the superior orbital margin

and supplies the scalp. It passes backward close to the median plane and reaches nearly as far as the vertex of the skull.

- The **supraorbital nerve**, a branch of the ophthalmic division of the trigeminal nerve, winds around the superior orbital margin and ascends over the forehead. It supplies the scalp as far backward as the vertex.
- The **zygomaticotemporal nerve**, a branch of the maxillary division of the trigeminal nerve, supplies the scalp over the temple.
- The **auriculotemporal nerve**, a branch of the mandibular division of the trigeminal nerve, ascends over the side of the head from in front of the auricle. Its terminal branches supply the skin over the temporal region.
- The **lesser occipital nerve**, a branch of the cervical plexus (C2), supplies the scalp over the lateral part of the occipital region and the skin over the medial surface of the auricle.
- The **greater occipital nerve**, a branch of the posterior ramus of the second cervical nerve, ascends over the back of the scalp and supplies the skin as far forward as the vertex of the skull.

Arterial Supply of the Scalp

The scalp has a rich supply of blood to nourish the hair follicles, and, for this reason, the smallest cut bleeds profusely. The arteries lie in the superficial fascia. Moving laterally from the midline anteriorly, the following arteries are present:

- The supratrochlear and the **supraorbital arteries**, branches of the ophthalmic artery, ascend over the forehead in company with the supratrochlear and supraorbital nerves.
- The **superficial temporal artery**, the smaller terminal branch of the external carotid artery, ascends in front of the auricle in company with the auriculotemporal nerve. It divides into anterior and posterior branches, which supply the skin over the frontal and temporal regions.

- The **posterior auricular artery**, a branch of the external carotid artery, ascends behind the auricle to supply the scalp above and behind the auricle.
- The **occipital artery**, a branch of the external carotid artery, ascends from the apex of the posterior triangle, in company with the greater occipital nerve. It supplies the skin over the back of the scalp and reaches as high as the vertex of the skull.

Venous Drainage of the Scalp

The supratrochlear and supraorbital veins unite at the medial margin of the orbit to form the facial vein.

The superficial temporal vein unites with the maxillary vein in the substance of the parotid gland to form the retromandibular vein.

The posterior auricular vein unites with the posterior division of the retromandibular vein, just below the parotid gland, to form the external jugular vein.

The occipital vein drains into the suboccipital venous plexus, which lies beneath the floor of the upper part of the posterior triangle; the plexus in turn drains into the vertebral veins or the internal jugular vein.

The veins of the scalp freely anastomose with one another and are connected to the diploic veins of the skull bones and the intracranial venous sinuses by the valveless emissary veins.

Lymph Drainage of the Scalp

Lymph vessels in the anterior part of the scalp and forehead drain into the submandibular lymph nodes. Drainage from the lateral part of the scalp above the ear is into the superficial parotid (preauricular) nodes; lymph vessels in the part of the scalp above and behind the ear drain into the mastoid nodes. Vessels in the back of the scalp drain into the occipital nodes.

The Face

Skin of the Face

The skin of the face possesses numerous sweat and sebaceous glands. It is connected to the underlying bones by loose connective tissue, in which are embedded the muscles of facial expression. No deep fascia is present in the face.

Wrinkle lines of the face result from the repeated folding of the skin perpendicular to the long axis of the underlying contracting muscles, coupled with the loss of youthful skin elasticity. Surgical scars of the face are less conspicuous if they follow the wrinkle lines.

Sensory Nerves of the Face

The skin of the face is supplied by branches of the three divisions of the trigeminal nerve, except for the small area over the angle of the mandible and the parotid gland, which is supplied by the great auricular nerve (C2 and 3).

These nerves not only supply the skin of the face, but also supply proprioceptive fibers to the underlying muscles of facial expression. They are, in addition, the sensory nerve supply to the mouth, teeth, nasal cavities, and paranasal air sinuses.

Ophthalmic Nerve

The ophthalmic nerve supplies the skin of the forehead, the upper eyelid, the conjunctiva, and the side of the nose down to and including the tip. Five branches of the nerve pass to the skin.

- The **lacrimal nerve** supplies the skin and conjunctiva of the lateral part of the upper eyelid.
- The **supraorbital nerve** winds around the upper margin of the orbit at the supraorbital notch. It divides into branches that supply the skin and conjunctiva on the central part of the upper eyelid; it also supplies the skin of the forehead.
- The **supratrochlear nerve** winds around the upper margin of the orbit medial to the supraorbital nerve. It divides into branches

that supply the skin and conjunctiva on the medial part of the upper eyelid and the skin over the lower part of the forehead, close to the median plane.

- The **infratrochlear nerve** leaves the orbit below the pulley of the superior oblique muscle. It supplies the skin and conjunctiva on the medial part of the upper eyelid and the adjoining part of the side of the nose.
- The **external nasal nerve** leaves the nose by emerging between the nasal bone and the upper nasal cartilage. It supplies the skin on the side of the nose down as far as the tip.

Maxillary Nerve

The maxillary nerve supplies the skin on the posterior part of the side of the nose, the lower eyelid, the cheek, the upper lip, and the lateral side of the orbital opening. Three branches of the nerve pass to the skin.

- The **infraorbital nerve** is a direct continuation of the maxillary nerve. It enters the orbit and appears on the face through the infraorbital foramen. It immediately divides into numerous small branches, which radiate out from the foramen and supply the skin of the lower eyelid and cheek, the side of the nose, and the upper lip.
- The **zygomaticofacial nerve** passes onto the face through a small foramen on the lateral side of the zygomatic bone. It supplies the skin over the prominence of the cheek.
- The **zygomaticotemporal nerve** emerges in the temporal fossa through a small foramen on the posterior surface of the zygomatic bone. It supplies the skin over the temple.

Mandibular Nerve

The mandibular nerve supplies the skin of the lower lip, the lower part of the face, the temporal region, and part of the auricle. It then passes upward to the side of the scalp. Three branches of the nerve pass to the skin.

- The **mental nerve** emerges from the mental foramen of the mandible and supplies the skin of the lower lip and chin.
- The **buccal nerve** emerges from beneath the anterior border of the masseter muscle and supplies the skin over a small area of the cheek.
- The **auriculotemporal nerve** ascends from the upper border of the parotid gland between the superficial temporal vessels and the auricle. It supplies the skin of the auricle, the external auditory meatus, the outer surface of the tympanic membrane, and the skin of the scalp above the auricle.

Arterial Supply of the Face

The face receives a rich blood supply from two main vessels: the facial and superficial temporal arteries, which are supplemented by several small arteries that accompany the sensory nerves of the face.

The facial artery arises from the external carotid artery. Having arched upward and over the submandibular salivary gland, it curves around the inferior margin of the body of the mandible at the anterior border of the masseter muscle. It is here that the pulse can be easily felt. It runs upward in a tortuous course toward the angle of the mouth and is covered by the platysma and the risorius muscles. It then ascends deep to the zygomaticus muscles and the levator labii superioris muscle and runs along the side of the nose to the medial angle of the eye, where it anastomoses with the terminal branches of the ophthalmic artery.

Branches

- The **submental artery** arises from the facial artery at the lower border of the body of the mandible. It supplies the skin of the chin and lower lip.
- The **inferior labial artery** arises near the angle of the mouth. It runs medially in the lower lip and anastomoses with its fellow of the opposite side.
- The **superior labial artery** arises near the angle of the mouth. It runs medially in the upper lip and gives branches to the septum and ala of the nose.
- The **lateral nasal artery** arises from the facial artery alongside the nose. It supplies the skin on the side and dorsum of the nose.
- The **superficial temporal artery**, the smaller terminal branch of the external carotid artery, commences in the parotid gland. It ascends in front of the auricle to supply the scalp.
- The **transverse facial artery**, a branch of the superficial temporal artery, arises within the parotid gland. It runs forward across the cheek just above the parotid duct.
- The **supraorbital and supratrochlear arteries**, branches of the ophthalmic artery, supply the skin of the forehead.

Venous Drainage of the Face

The facial vein is formed at the medial angle of the eye by the union of the supraorbital and supratrochlear veins. It is connected to the superior ophthalmic vein directly through the supraorbital vein. By means of the superior ophthalmic vein, the facial vein is connected to the cavernous sinus; this connection is of great clinical importance because it provides a pathway for the spread of infection from the face to the cavernous sinus. The facial vein descends behind the facial artery to the lower margin of the body of the mandible. It crosses superficial to the submandibular gland and is joined by the anterior division of the retromandibular vein. The facial vein ends by draining into the internal jugular vein.

Tributaries

The facial vein receives tributaries that correspond to the branches of the facial artery. It is joined to the pterygoid venous plexus by the deep facial vein and to the cavernous sinus by the superior ophthalmic vein. The transverse facial vein joins the superficial temporal vein within the parotid gland.

Lymph Drainage of the Face

Lymph from the forehead and the anterior part of the face drains into the submandibular lymph nodes. A few buccal lymph nodes may be present along the course of these lymph vessels. The lateral part of the face, including the lateral parts of the eyelids, is drained by lymph vessels that end in the parotid lymph nodes. The central part of the lower lip and the skin of the chin are drained into the submental lymph nodes.

Bones of the Face

The superior orbital margins and the area above them are formed by the frontal bone, which contains the frontal air sinuses. The lateral orbital margin is formed by the zygomatic bone and the inferior orbital margin is formed by the zygomatic bone and the maxilla. The medial orbital margin is formed above the maxillary process of the frontal bone and below by the frontal process of the maxilla.

The root of the nose is formed by the nasal bones, which articulate below with the maxilla and above with the frontal bones. Anteriorly, the nose is completed by upper and lower plates of hyaline cartilage and small cartilages of the ala nasi.

The important central bone of the middle third of the face is the maxilla, containing its teeth and the maxillary air sinus. The bone of the lower third of the face is the mandible, with its teeth. A more detailed account of the bones of the face is given in the discussion of

Muscles of the Face (Muscles of Facial Expression)

The muscles of the face are embedded in the superficial fascia, and most arise from the bones of the skull and are inserted into the skin. The orifices of the face, namely, the orbit, nose, and mouth, are guarded by the eyelids, nostrils, and lips, respectively. It is the function of the facial muscles to serve as sphincters or dilators of these structures. A secondary function of the facial muscles is to modify the expression of the face. All the muscles of the face are developed from the second pharyngeal arch and are supplied by the facial nerve.

Muscles of the Eyelids

The sphincter muscle of the eyelids is the orbicularis oculi, and the dilator muscles are the levator palpebrae superioris and the occipitofrontalis.. The occipitofrontalis also forms part of the scalp.

Muscles of the Nostrils

The sphincter muscle is the compressor naris and the dilator muscle is the dilator naris.

Muscles of the Lips and Cheeks

The sphincter muscle is the orbicularis oris. The dilator muscles consist of a series of small muscles that radiate out from the lips.

Sphincter Muscle of the Lips: Orbicularis Oris

- Origin and insertion: The fibers encircle the oral orifice within the substance of the lips. Some of the fibers arise near the midline from the maxilla above and the mandible below. Other fibers arise from the deep surface of the skin and pass obliquely to the mucous membrane lining the inner surface of the lips. Many of the fibers are derived from the buccinator muscle.
- Nerve supply: Buccal and mandibular branches of the facial nerve
- Action: Compresses the lips together

Dilator Muscles of the Lips

The dilator muscles radiate out from the lips, and their action is to separate the lips; this movement is usually accompanied by separation of the jaws.

The muscles arise from the bones and fascia around the oral aperture and converge to be inserted into the substance of the lips. Traced from the side of the nose to the angle of the mouth and then below the oral aperture, the muscles are named as follows:

- Levator labii superioris alaeque nasi
- Levator labii superioris
- Zygomaticus minor
- Zygomaticus major
- Levator anguli oris (deep to the zygomatic muscles)
- Risorius
- Depressor anguli oris
- Depressor labii inferioris
- Mentalis

Nerve Supply

Buccal and mandibular branches of the facial nerve

Muscle of the Cheek

Buccinator

- **Origin**: From the outer surface of the alveolar margins of the maxilla and mandible opposite the molar teeth and from the pterygomandibular ligament
- **Insertion**: The muscle fibers pass forward, forming the muscle layer of the cheek. The muscle is pierced by the parotid duct. At the angle of the mouth the central fibers decussate, those from below entering the upper lip and those from above entering the lower lip; the highest and lowest fibers continue into the upper

and lower lips, respectively, without intersecting. The buccinator muscle thus blends and forms part of the orbicularis oris muscle.

- **Nerve supply**: Buccal branch of the facial nerve
- **Action**: Compresses the cheeks and lips against the teeth

Facial Nerve

As the facial nerve runs forward within the substance of the parotid salivary gland, it divides into its five terminal branches.

- The **temporal branch** emerges from the upper border of the gland and supplies the anterior and superior auricular muscles, the frontal belly of the occipitofrontalis, the orbicularis oculi, and the corrugator supercilii.
- The **zygomatic branch** emerges from the anterior border of the gland and supplies the orbicularis oculi.
- The **buccal branch** emerges from the anterior border of the gland below the parotid duct and supplies the buccinator muscle and the muscles of the upper lip and nostril.
- The **mandibular branch** emerges from the anterior border of the gland and supplies the muscles of the lower lip.
- The **cervical branch** emerges from the lower border of the gland and passes forward in the neck below the mandible to supply the platysma muscle; it may cross the lower margin of the body of the mandible to supply the depressor anguli oris muscle.

The facial nerve is the nerve of the second pharyngeal arch and supplies all the muscles of facial expression. It does not supply the skin, but its branches communicate with branches of the trigeminal nerve. It is believed that the proprioceptive nerve fibers of the facial muscles leave the facial nerve in these communicating branches and pass to the central nervous system via the trigeminal nerve.