DESCRIPTIVE ATLAS OF

SURGICAL ANATOMY

IRVING REHMAN, M.S., Ph.D.

Associate Professor of Anatomy, School of
Medicine, University of Southern California
Consultant, Los Angeles County General Hospital
Consultant, U.S. Naval Hospital, San Diego

and

NATHAN HIATT, M.D.

Attending Surgical Staffs
Cedars of Lebanon and Mount Sinai Hospitals
Los Angeles

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To my wife, Sonny Rehman, whose inspiration
and constant encouragement played a major role
in bringing this work to fruition.

To Mickey, Vicki, and Sam Hiatt, who
relinquished many play days to make this book possible.

PREFACE

This book is the culmination of many years of teaching surgical anatomy with colored photographs showing dissections of fresh, unembalmed cadaveric material. The favorable response of many students and surgeons to our method has resulted in this endeavor.

We have found the best method of presentation is to employ a sequence which approximates that performed by the surgeon. Our teaching was most successful when fresh, unembalmed cadaveric material was used, since this most closely resembles what the surgeon actually sees on the operating table. Because fresh cadaveric material is not usually available, colored photographs of such material have proved a most satisfactory substitute.

Numerous excellent texts of anatomy and surgical anatomy are available. However, this book differs in that it is a visit to the morgue in the company of an anatomist and a surgeon. The colored photographs, black and white drawings, and text are designed to give the student or surgeon a review of the anatomy seen on the operating table.

Much of the text and some of the drawings derive from the vast pool of anatomic and surgical literature and illustrations that has collected since the time of Vesalius. Adequate acknowledgment of the sources has not always been possible, but credits have not been intentionally omitted.

We are indebted to Miss Gene Eisert, whose understanding of our approach to anatomic and surgical problems has made her black and white drawings an outstanding part of this work. The majority of her illustrations were drawn directly from fresh material. Because of this fact, the illustrations are original contributions to the field of medical art. We are also grateful to Mr. Phillip Alexander and his staff at the Cedars of Lebanon Hospital Library for their untiring efforts in the preparation of the text. And we offer our grateful thanks to Dr. Paul R. Patek and the staff of the Department of Anatomy of the University of Southern California School of Medicine for their sincere help in correcting the text.

We would also like to thank the staff of The Blakiston Division of McGraw-Hill for their constant interest and support, even during the dark days when a book containing an extensive number of color photographs was not considered feasible. Their technical assistance with the illustrations, both color and black and white, has been invaluable.

Irving Rehman, Ph.D.
Nathan Hiatt, M.D.

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HEAD AND NECK

HEAD

Scalp

The scalp is formed of five layers, of which the outer three, consisting of skin, dense connective tissue, and galea aponeurotica, or occipitofrontalis aponeurosis, are firmly bound together. Deep to this united layer is the loose connective tissue overlying the periosteal, or pericranial, layer. Within the dense connective tissue the blood vessels are bound firmly and therefore bleed freely when severed. This firm union also prevents ready placement of hemostats on the vessels when cut. The blood supply is very extensive, and for this reason too, profuse bleeding occurs when the scalp is wounded. Fluid effusions spread very readily through the loose connective tissue layer deep to the galea aponeurotica. Injuries involving the subaponeurotic area and skull are dangerous because of the direct communication through emissary veins with the interior of the cranium.

The neural innervation of the scalp is profuse; it is derived from the divisions of the trigeminal nerve anteriorly and laterally and from the cervical nerves posteriorly.

The lymphatics of the scalp do not follow the arterial supply or venous drainage (Figs. 1 and 2). Anteriorly, the lymphatics drain into parotid and preauricular nodes and thence to the submaxillary nodes. The lateral, or temporal and parietal, lymphatics drain to the nodes of the parotid, preauricular nodes, and postauricular nodes and thence to the submaxillary and deep cervical chain. The lymphatics of the occipital region drain to the occipital nodes and to those of the upper deep chain (Fig. 2).

Orbital Region

The frontal muscular portion of the occipitofrontalis aponeurosis is continuous with the orbicularis oculi muscle and the superciliary ridges and subcutaneous tissues. The subaponeurotic space is continuous with the periorbital connective tissue of the upper and lower eyelids (Plates 1–1 to 1–3). The skin overlying the thin orbicularis oculi muscle of the upper eyelid is extremely thin and loose. The skin and orbicularis oculi muscle overlie the tarsal plates, over which they move freely.

The vascular supply to the eyelids is very rich, and since the skin is loose, a direct blow to the eye will lead to profuse subcutaneous hemorrhage into the loose underlying tissues (black eye). A black eye will appear very shortly after the blow. Fracture of the skull leading to hemorrhage within the orbit will not result in a black eye, since the hemorrhage will be confined to the orbital cavity by the attachment of the orbital septum. The hemorrhage will appear beneath the conjunctiva as a subconjunctival hemorrhage.

The innervation and vascular supply to the superficial orbital area is derived from the ophthalmic and maxillary nerves and arteries to the periphery of the orbit.

The lacrimal gland lies deep to the orbicularis oculi muscle and orbital septum in the superolateral aspect of the orbit. The drainage of the lacrimal gland occurs along the upper and lower eyelids toward the medial aspect of the eye through the lacrimal ducts, which empty into the lacrimal sac. The lacrimal ducts at the medial aspect of the upper and lower eyelids lie in an extremely superficial plane as they drain medially to the lacrimal sac. In this area they may be easily injured and may be included in sutures placed within the skin of this area. The lacrimal sac drains inferiorly into the inferior meatus of the nose through the nasolacrimal duct.

External Ear

The skin is very firmly bound down to the cartilage and perichondrium of the cartilaginous portion

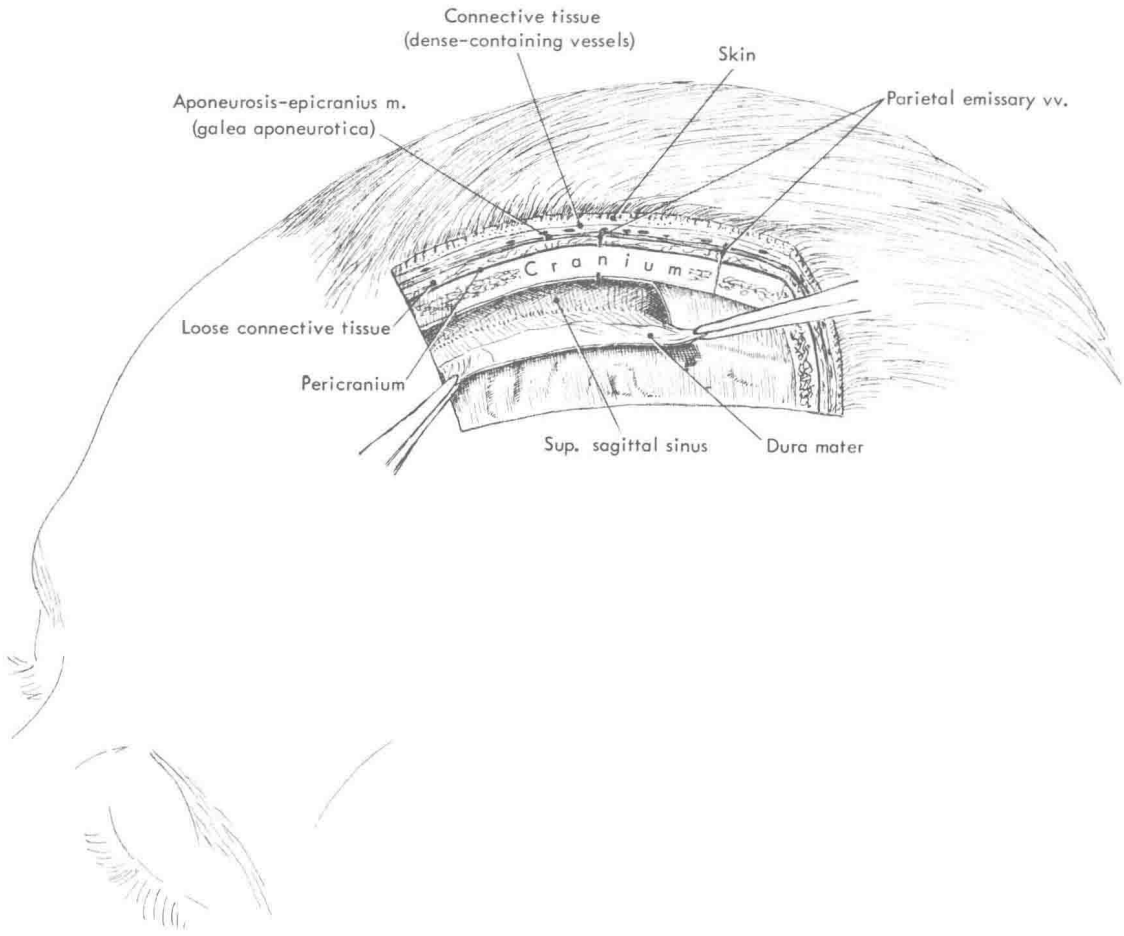

Fig. 1. Layers of the scalp.

of the external auditory meatus and to the periosteum of the deeper bony canal, so that inflammation in this area becomes extremely painful. The ear derives its innervation from the auriculotemporal branch of the mandibular division of the trigeminal, from the vagus, and the branches of the great auricular and lesser occipital nerves. The very small muscles of the ear derive their innervation from the facial nerve. The blood supply is derived from branches of the superficial temporal, posterior auricular, and nearby superficial arteries. The venous drainage is into the superficial temporal and external jugular veins and adjacent tributaries. The lymphatic drainage of the ear passes anteriorly into the preauricular glands and deep cervical chain. Posteriorly the lymphatic drainage passes to the mastoid glands and then to the uppermost portion of the deep cervical chain. The anterior wall of the external third of the external auditory canal consists of fibrocartilage and contains small fissures which lie in contact with the parotid gland. Infections of the parotid may pass through these fissures (Santorini's fissures) into the external auditory canal. Anterior to the external auditory canal and separated from it by an upward extension of the parotid gland is the temporomandibular joint and capsule. This extension of the parotid gland, constricted upward behind the posterior wall of the capsule of the temporomandibular joint, contains the auriculotemporal nerve and the superficial temporal vessels. The head of the mandible lies in close proximity to the anterior wall of the external auditory canal. Injury to the external auditory canal with bleeding may result from blows on the chin and may be confused with skull fracture (Plates 2–1 and 2–2).

Nose

External Nose. The arterial blood supply to the superficial nasal area is derived from the facial branch of the external carotid and the dorsal nasal branch of the ophthalmic artery, which has its origin in the

internal carotid artery. The veins lying within the subcutaneous looser skin at the root of the nose and the firmer skin at the tip and lateral aspect of the nose drain into the anterior facial vein, which in turn drains inferiorly into the common facial vein. Superiorly, the anterior facial vein drains into the superior ophthalmic vein in the orbit, which in turn drains into the cavernous sinus. The anterior facial vein also communicates with the pterygoid plexus of veins through the deep facial vein. These various communicating veins provide paths for the spread of infection, since no valves are present in the veins of the head and face.

The lymphatic drainage passes inferiorly into the submaxillary nodes of the deep cervical chain (Fig. 2).

Internal Nose. The nasal septum and lateral wall are very highly vascularized. Posteriorly they derive their blood supply mainly from the terminal branch of the internal maxillary artery, i.e., the spheno-

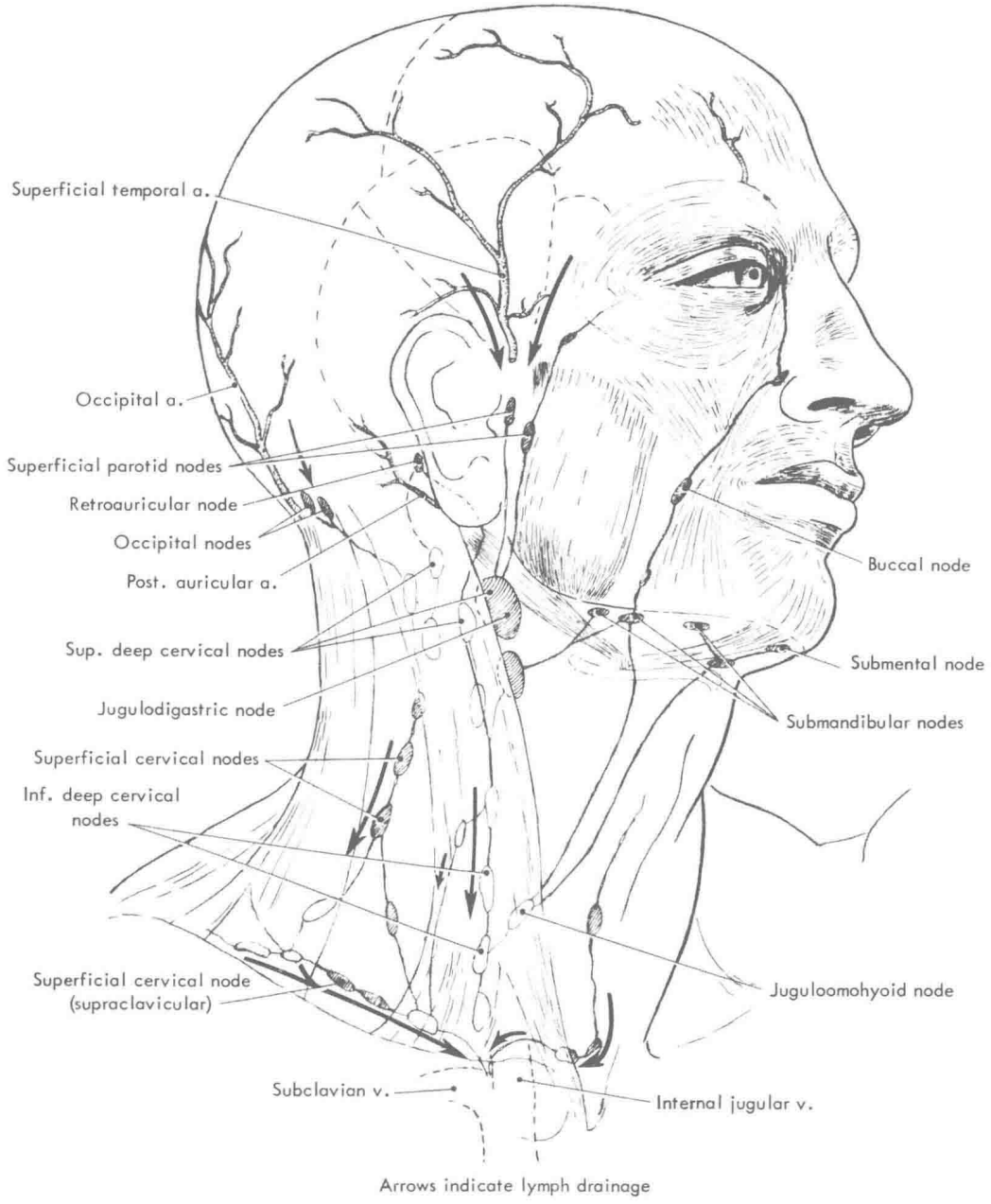

Fig. 2. The lymphatics of the head and neck.

palatine. This vessel gives off a posterolateral nasal artery and continues on the septum as the posterior septal artery. Superiorly and anteriorly the lateral wall and septum are supplied by the anterior and posterior ethmoid branches of the ophthalmic artery. A richer venous nasal network accompanies the arterial supply. Some of the veins accompanying the anterior and posterior ethmoid veins to the ophthalmic veins provide a pathway for infection from the nose to the cavernous sinus. The midportion of the nasal roof is made up of the cribriform plate of the ethmoid, through which the olfactory nerve filaments and anterior and posterior ethmoid vessels pass. The cribriform plate of the ethmoid is very susceptible to fracture in injuries of the head; consequently, the olfactory nerve is frequently involved. The close contact of the nasal mucoperiosteum with the dura and arachnoid in this area permits tears in the dura and arachnoid over the cribriform plate and leakage of the cerebrospinal fluid into the nasal cavity, thus providing a ready path for the spread of infection from the nasal cavity into the meninges.

Mouth Region

The lips consist of the fairly thick skin, or cutaneous layer, attached to the underlying fascia and orbicularis oris muscle. Beneath the orbicularis oris muscle is the glandular and mucous tissue in which the labial branches of the facial artery are found. Since the arterial supply from the external maxillary artery lies in the plane between the mucosa and the orbicularis oris muscle, blows upon the lip causing the teeth to penetrate the mucosa and submucosa will result in hemorrhaging into the mouth. The lymphatics of the lips lie in the cutaneous and mucosal planes and drain inferiorly to the submental and submaxillary regions. The lymphatic drainage of the upper lip parallels the facial vessels and drains to the submaxillary nodes. The lymphatics of the lower lip drain to the anterior portion of the submaxillary and to the submental nodes. The lymphatic drainage of the medial portion of the lower lip decussates to the submental nodes of the opposite side. These in turn drain into the deep cervical nodes.

The motor innervation to the muscles of the mouth region is derived from the facial nerve. The orbicularis oris muscle closes the oral orifice, whereas the remaining muscles about the mouth insert into the lateral angle of the mouth and open it. The sensory innervation is derived from the infraorbital, buccal, and mental branches of the trigeminal nerve.

Buccal Region. The lateral continuation of the mouth forms the cheek, or buccal area, and has the same general structure as the lips (Plates 2–1 to 3–2). Lying in the plane between the skin and superficial fascia and the underlying buccinator muscle and mucosal layers is the thick, encapsulated buccal fat pad. The buccal fat pad overlies the anterior and lateral aspects of the masseter muscle and ramus of the mandible. It extends deeply into the infratemporal fossa and superiorly beneath the zygoma into the temporal fossa. Passing anteriorly over the buccal fat pad is the parotid duct, or Stensen's duct. It courses anteriorly from the superficial lobe of the parotid gland over the masseter muscle to its anterior border, where it turns medially, forming a right angle in its course. It then pierces the buccinator muscle and terminates in the mouth opposite the upper second molar tooth. A thin muscle sheet, the buccinator muscle, forms the deeper limit of the buccal area. This thin muscle layer is firmly bound down to the considerably thicker connective tissue and mucosal layers.

The blood supply to the buccal area is derived from the facial artery. It passes superiorly from the anteroinferior margin of the masseter muscle to the lateral angle of the mouth and thence along the lateral border of the nose to the medial aspect of the orbit as the angular artery. It follows a tortuous course and gives off numerous branches to the upper and lower face, lips, and nasal areas. The artery lies deep to the muscles of facial expression and when cut will retract readily and may bleed freely from both cut ends because of the rich collateral anastomosis with the artery of the other side. The anterior facial vein and external maxillary artery approximate each other as they pass over the inferior border of the mandible, at the anteroinferior margin of the masseter muscle. Superiorly, these two vessels part company; the vein passes inferiorly from the medial angle of the orbit, whereas the artery follows a tortuous course, in close proximity to the nose, to the inner angle of the eye. The anterior facial vein provides a venous pathway to the inferior ophthalmic vein and to the pterygoid plexus. The lymphatic drainage of the buccal area passes inferiorly into the submaxillary and deep cervical nodes.

Interior Mouth. The general surgeon is primarily interested in the lymphatic drainage of the mouth rather than the topography of its soft tissues. Anteriorly the mucous membrane of the floor of the mouth overlies the genioglossus, geniohyoid, and mylohyoid muscles which separate the anterior portion of the floor of the mouth from the superficially (inferiorly) placed submental triangle. More posteriorly the mucosa overlies only the mylohyoid and hyoglossus

muscles, so that there is an area of relatively close contact between the floor of the mouth and submaxillary triangle. The anterior area contains the frenulum of the tongue, the sublingual gland and its ducts, and the termination of the submaxillary duct. The mylohyoid muscle arises from, and is firmly attached to, the mandible and inserts into a median raphe of fibrous tissue and hyoid bone, whereas the overlying mucosa is loosely attached. Swelling in this area may distend the mucosa and elevate the anterior aspect of the tongue, rotating it and pushing it posteriorly into the pharynx, thus possibly obstructing the airway. The lymphatics of the anterior aspect of the floor of the mouth drain inferiorly into the superior deep cervical group or through the submental and submaxillary nodes to the superior deep cervical nodes. The lymphatics drain to their own side, except for those lying on the tip and frenulum of the tongue, which may cross to the opposite side.

The submaxillary duct lies in a submucosal position for a considerable portion of its course, and therefore stones within it can be readily palpated through the floor of the mouth. The lateral aspect of the floor of the mouth exhibits the same characteristics as the anterior portion of the floor of the mouth. However, the lymphatics differ somewhat in their drainage pathways. The lymphatics drain inferiorly to the submaxillary nodes as well as posteriorly to the jugulodigastic sentinal nodes comprising the uppermost portion of the superior deep cervical and subparotid nodes. Additional drainage occurs laterally through the periosteum of the mandible, and vice versa, so that in involvements of the lymphatics of the floor of the mouth the periosteum of the mandible becomes involved as well. Lying on the hyoglossus muscle in a superoinferior relationship is the lingual nerve above and the submandibular duct and hypoglossal nerve in that order below as they course from posterior to anterior.

Tongue. The tongue may be surgically divided into an anterior two-thirds (mobile portion) and posterior one-third (base). The anterior two-thirds may be readily approached. A superficial landmark on the dorsal aspect of the tongue is the cecal foramen, an indentation lying at the junction of the anterior two-thirds and posterior one-third of the tongue. The lymphatics of the apical portion of the tongue (anterior third) drain into the submental, or suprahyoid, nodes and primarily into the principal node of the tongue on the internal jugular vein located where the omohyoid muscle crosses at the bifurcation of the carotid artery. The lateral midportion of the tongue drains to the submaxillary nodes and to the upper deep cervical nodes. The central, or midportion, of the tongue also drains along these routes but in addition may drain to the corresponding nodes of the opposite side. The lymphatic drainage of the posterior third of the tongue is markedly different in that the drainage passes through the pharyngeal wall to the superior deep cervical nodes (subdigastric group).

The tongue is a highly vascularized structure deriving its blood supply from branches of the lingual artery. This vessel lies within the deeper portion of the tongue, i.e., deep to the hyoglossus muscle, and terminates anteriorly as the deep lingual artery. Its accompanying veins lie on the inferior surface of the tongue in a submucosal plane. A large ranine vein usually accompanies the hypoglossal nerve and terminates in the lingual or common facial veins.

Palate. The mucosa and submucosa of the hard palate are firmly bound down to the bony palate (Fig. 3). The mucosa and submucosa of the soft palate are intimately attached to the underlying palatine muscles except in the region of the uvula, where the submucosa is loosely attached to the underlying structures. Lying within the submucosal plane are the many palatine glands. The blood supply to the palate is derived anteriorly from the greater palatine branch and posteriorly and laterally from the descending branches of the internal maxillary artery. The veins parallel the arterial supply. The sensory innervation is derived from branches of the maxillary nerve passing through the sphenopalatine ganglion as descending palatine nerves. The lymphatics of the soft palate drain to the subparotid and retropharyngeal nodes, and the remainder of the soft and hard palate drain to the superior nodes of the deep cervical chain.

The soft palate extends posteriorly from the hard palate and continues laterally to the tongue as the glossopalatine muscle, or anterior pillar of the fauces of the tonsil, and posteriorly to the pharynx as the pharyngopalatinus muscle, the posterior pillar of the tonsillar fossa. The palatine tonsil lies between the anterior and posterior pillars. The lymphatics draining the tonsil pass inferiorly to the jugulodigastric nodes of the deep cervical chain.

PAROTID REGION

The skin and subcutaneous tissue over the lateral aspect of the face and neck are loose and readily reflected from the subjacent structures, exposing the masseter and temporal muscles, parotid gland, upper

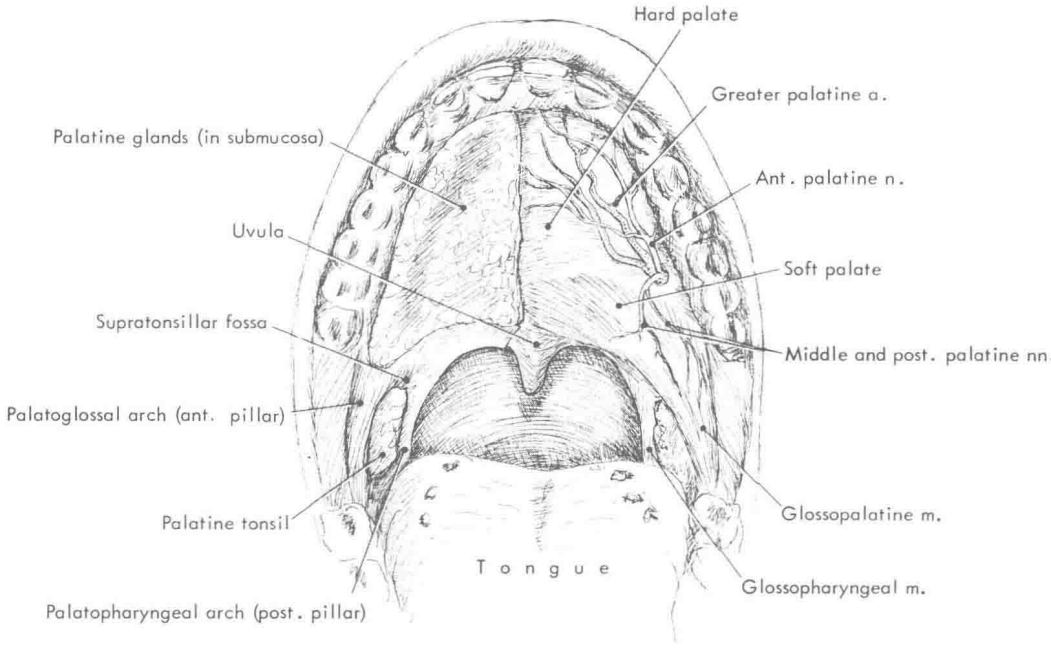

Fig. 3. Palate. (*Redrawn from Warren, Handbook of Anatomy.*)

branches of the cervical plexus of nerves, and external jugular vein. The superficial branches of the facial nerve become terminal branches superficially at the anterior border and upper and lower extremities of the gland. The parotid gland varies in size and often extends inferiorly for several centimeters into the neck. The parotid duct emerges from the anterior aspect of the gland, lies approximately 1 cm below the zygoma, and runs forward for 1 to 2 cm to the anterior border of the masseter muscle. It then turns medially and pierces the buccal fat pad and the buccinator muscle to terminate in the mouth opposite the upper second molar tooth. A small branch of the superficial temporal artery, the transverse facial, and a buccal branch of the facial nerve accompany the duct as it courses forward on a horizontal level extending from the inferior lobe of the ear to the midportion of the upper lip. The mandibular branch of the facial nerve parallels the inferior border of the mandible and crosses superficial to the facial vein and external maxillary artery (Fig. 4; Plates 3–3 to 5–1).

The parotid gland is firmly imbedded by means of septums in its fibrous connective tissue capsule and therefore cannot be shelled out very easily. The deep portion of the parotid lies in close proximity to the pharynx and extends deeply behind the ramus of the mandible to the styloid process. The upper portion of the parotid gland lies in contact with the inferior surface of the external auditory canal and zygomatic process. To expose the upper border of the parotid one must retract the ear and external auditory meatus upward. The deeper aspect of the parotid gland lies in contact with the posterior belly of the digastric and pharyngeal wall. One should be aware of the deeper relations of the parotid to the ninth, tenth, eleventh, and twelfth cranial nerves as well as the wall of the pharynx and the internal carotid artery and internal jugular vein. The auriculotemporal branch of the mandibular nerve passes through the upper portion of the parotid gland between the head of the mandible and external auditory canal and into the temporal area.

The superficial layer of the capsule of the parotid is thin anteriorly where it passes forward to fuse with the deep fascia on the masseter muscle. Posteriorly the capsule thickens as it passes over the mastoid to fuse with the deep fascia of the sternocleidomastoid muscle. Incision of this avascular fascia at the posterior border of the parotid gland allows the parotid to be pulled forward. Retraction of the ear upward permits the development of a space between the mastoid process, the parotid covering the posterior border of the ramus of the mandible, and the anteroinferior surface of the external auditory canal. It is usually possible to palpate the styloid process or its vaginal sheath and associated muscles in the floor of this space.

Passing superficially over the inferior portion of this area are branches of the great auricular nerve. The posterior belly of the digastric muscle, the

stylohyoid muscle, and the extracranial, retroparotid portion of the facial nerve lie deepest within this region behind and deep to the mandible. This part of the facial nerve, .5 to 1 cm long, emerges from the stylomastoid foramen and passes around the lateral and posterior aspects of the styloid process close to the base of the skull. Just above the origin of the posterior belly of the digastric muscle, the facial nerve gives off filaments to the digastric and stylohyoid muscles and continues anteriorly as a single trunk into the substance of the parotid gland. The interval between the mastoid process and ramus of the mandible may be developed to a depth of 1.5 cm before the trunk of the facial nerve is visualized.

After entering the deeper aspect of the parotid gland, the facial nerve divides into its two main divisions (temporofacial and cervicofacial), which pass superficial to the posterior facial vein within the parotid gland.

The upper temporofacial division of the facial nerve is larger than the lower cervicofacial division. The upper division gives rise to the temporal, zygomatic, and buccal branches; the lower, to buccal, marginal mandibular, and cervical branches. The branches of the divisions of the nerve are highly variable, and the arborizations between the branches may be very complex, the cervical division, however, being the simpler.

The smaller deep portion, or lobe, of the parotid gland lies deep to the branches of the facial nerve and posterior and medial to the posterior border of the ramus of the mandible. It is usually smaller than the superficial lobe and connected to it by a broad isthmus of glandular tissue. It may extend deeply to the pharyngeal wall. The cervical portion of the parotid gland lies in close proximity to the posterior pole of the superficial lobe of the submaxillary gland from which it is separated by a somewhat thickened fascial layer, the stylomandibular ligament.

FASCIA AND SPACES OF THE FACE

Fascia

The parotid area encompasses the parotid gland, which overlies the major portion of the masseter muscle. This muscle arises from the zygoma and attaches to the angle and lateral surface of the ramus of the mandible (Plates 2–1 to 3–2). The temporal muscle lies deep to the zygoma, arises from the temporal fossa and fascia, and inserts into the coronoid process and ramus of the mandible. A portion of the muscle continues along the anteromedial border of the ramus of the mandible to the retromolar fossa. The temporal muscle is covered by an extremely tough, thick layer of temporal fascia that extends

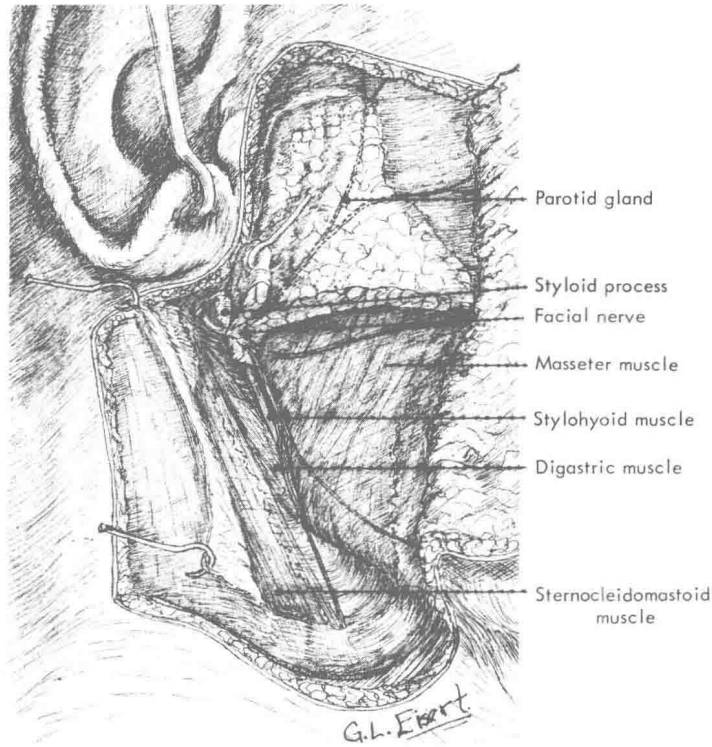

Fig. 4. Parotid gland and facial nerve.

from the superior temporal line to the zygoma and to the frontal process of the maxilla.

Masticator Space

Two muscles, the masseter and temporal, and the ramus of the mandible form the lateral boundary of the masticator space. The buccal and pharyngeal walls form the medial boundary of the deeper extensions of this space. (Figs. 5 and 6). Posteriorly this space may extend to the vertebral column and prevertebral musculature. Lying within the infratemporal portion of this space (masticator space) are the two pterygoid muscles (lateral and medial) and the branches of the third or mandibular division of the trigeminal nerve and internal maxillary artery.

Pterygoid Plexus of Veins

An extremely profuse plexus of veins (pterygoid plexus) lies deep to the temporal muscle, surrounds the lateral pterygoid muscle, and extends onto the lateral surface of the medial pterygoid muscle within the pterygomandibular extension of the masticator space of the face. These veins continue their drainage anteriorly to the facial vein, superiorly into the interior of the cranium to the cavernous sinus, posteriorly to the pharyngeal plexus of veins, and inferiorly to the internal jugular vein. Its tributaries parallel the internal maxillary artery.

The widespread potentially infratemporal portion of the masticator space extends into the floor of the mouth above the mylohyoid muscle and also anteriorly below the mylohyoid into the submaxillary and submental areas. Although these spaces tend to be continuous with each other, the parotid space is confined by the fascial sheath of the parotid.

Lying within the infratemporal portion of these spaces are the four muscles of mastication, i.e., the masseter, the temporal, and the lateral and medial pterygoid muscles. They are all innervated by the masticator, or motor, branch of the mandibular division of the trigeminal nerve. Accompanying these nerves are branches of the internal maxillary artery. The pterygomandibular portion of the masticator space is traversed obliquely by branches of the mandibular nerve arising at the foramen ovale deep to the lateral pterygoid muscle. These branches innervate the structures in the floor of the mouth and mandible as the inferior alveolar, mylohyoid, lingual, and buccinator nerves.

TRIGEMINAL NERVE: FACIAL BRANCHES

The sensory innervation of the face and mucous membrane of the mouth is derived from branches of the maxillary and mandibular divisions of the trigeminal nerve. The sensory branches of the trigem-

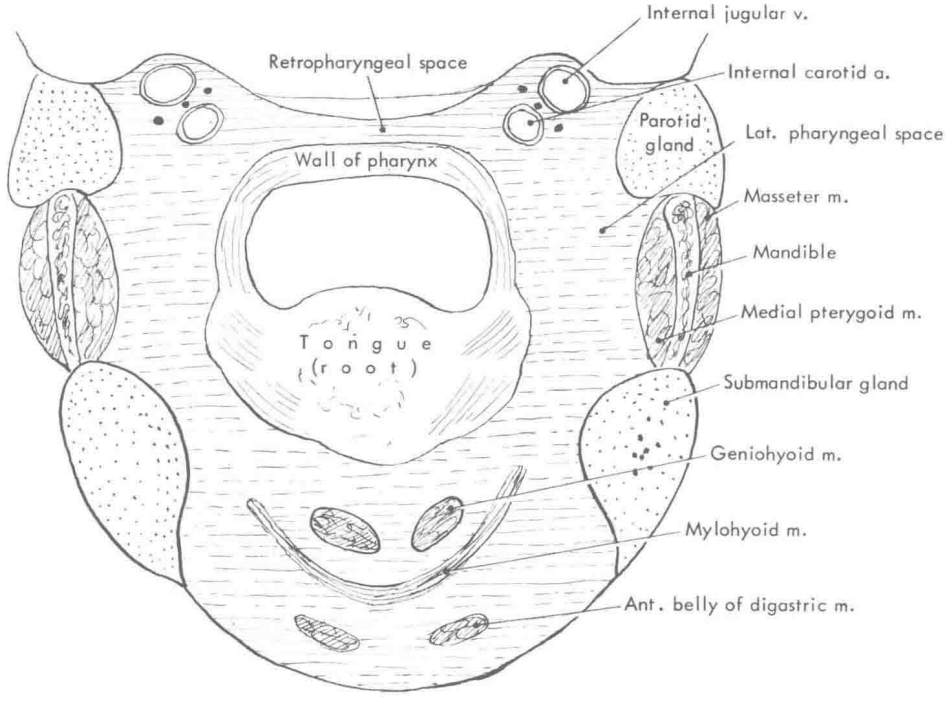

Fig. 5. Spaces of the face.

inal nerve run through bony canals and lie in fracture-susceptible areas, i.e., the supraorbital nerve through the supraorbital foramen, the infraorbital nerve through the groove and canal in the floor of the orbit, or roof of the maxillary sinus, and the inferior alveolar, or dental, branch of the mandibular nerve through the bony canal of the mandible. The third, or mandibular, division also contains motor fibers that innervate the muscles of mastication as well as the mylohyoid muscle and anterior belly of the digastric muscle. The facial nerve provides the motor innervation to the muscles of facial expression and to the buccinator muscle.

NECK AND PHARYNGEAL REGION

The pharynx may be subdivided into a nasal pharynx, an oral pharynx, and a laryngeal pharynx. The lymphatics of the nasal pharynx run primarily in a horizontal direction and drain to the retropharyngeal nodes, the uppermost nodes of the deep cervical chain. The lymphatic drainage in the region of the eustachian tube is profuse and follows the same direction to the superior nodes of the deep cervical chain, which in this region lie in close proximity to the ninth, tenth, eleventh, and twelfth cranial nerves.

The oral pharynx is the posterior continuation of the mouth, and therefore its lymphatic drainage also is continuous to the upper nodes of the deep cervical chain.

The lymphatic drainage of the laryngeal pharynx passes posteriorly to the retropharyngeal nodes and laterally to the deep cervical chain lying on the internal jugular vein. The uppermost nodes drain to the midcervical region; the remainder of the laryngopharynx and larynx drain laterally and inferiorly to the deep cervical chain of lymphatics on the internal jugular vein. In addition to the direct drainage to the deep cervical chain, the lymphatics may extend to the carotid sheath or to the internal jugular vein directly, or they may follow the lymphatic vessels to the superior mediastinum.

Retropharyngeal Space, Prevertebral Space

The pharyngeal wall is formed by mucosa, submucosa, and the constrictor musculature (Fig. 7; Plates 10–3 to 12–1). Where the inferior constrictor muscle of the pharynx meets the cricopharyngeus muscle, a small gap may exist posteriorly. This gap is covered over only by submucosa and mucosa. A pharyngeal hernia may occur here because of the

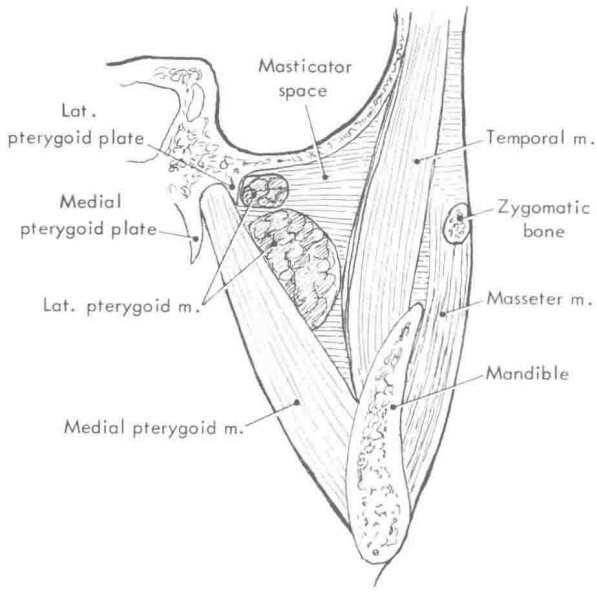

Fig. 6. Masticator space. (*Redrawn from Hollinshead, Anatomy for Surgeons, Hoeber, 1954.*)

looseness of the tissue and migrate either superiorly along the pharyngeal wall or posteriorly into the retropharyngeal space. Its primary course is lateral. The prevertebral fascia lies on the bodies of the vertebrae behind the pharynx, where it attaches to the base of the skull. Anteriorly this fascial layer is separated by loose connective tissue from the posterior pharyngeal wall. This prevertebral layer continues down into the superior and posterior mediastina. Another layer, the middle cervical layer, forms the buccopharyngeal fascia on the posterior surface of the pharyngeal wall. A retropharyngeal infection above the level of C 5 or C 6 may be limited to the neck because of the attachment of the alar portion of prevertebral fascia. This alar layer attaches to the pharyngeal wall at the level of C 5 or C 6. Below the level of this alar layer direct continuity of the retropharyngeal space into the superior and posterior mediastina occurs. The prevertebral space lies anterior to the prevertebral fascia, i.e., between it and the posterior pharyngeal wall. Another layer, the middle cervical layer, forms the buccopharyngeal fascia on the posterior surface of the pharyngeal wall.

Developmental Abnormalities

Lateral fistulas of the neck extend from the skin deeply to the pharynx and pass between the internal and external carotid arteries and open into the pharynx at the site of the second pharyngeal pouch, i.e., at the tonsillar fossa (Fig. 8). The course of a

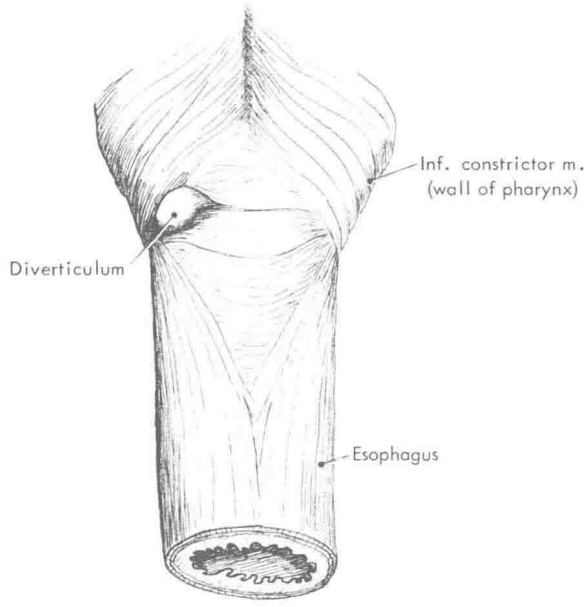

Fig. 7. Diverticulum of the esophagus.

lateral fistula lies deep to the hypoglossal nerve and superficial to the glossopharyngeal nerve as the fistula may pass to the anterior border of the sternocleidomastoid muscle to terminate above the sternoclavicular joint. A lateral fistula of the neck, unlike a branchial cyst, is firmly adherent to the surrounding tissues and therefore will not shell out easily.

A thyroglossal duct cyst can develop as a dilatation anywhere along the developmental tract of the thyroid gland, from the base of the tongue to the isthmus of the thyroid. The tract may pass anterior to, posterior to, or through the midportion of the body of the hyoid bone. This portion of the hyoid can be resected without affecting the attachment of the muscles of the tongue.

Cricothyroid Region

The cricothyroid ligament between the thyroid and cricoid cartilages may be used as the site of a tracheotomy incision (Plate 12–2). This space is widest in the midline anteriorly. As the cricoid increases in vertical extent posteriorly, it serves to protect the more posterior esophagus from penetration by a tracheotomy instrument. Incisions in the trachea below the thyroid cartilage avoid involvement of the laryngeal cords when tracheotomy is performed. The major vessels and nerves lie lateral to the incision.

The carotid artery can be compressed against the carotid tubercle of the sixth cervical vertebra, which is at the level of the cricoid cartilage.

Investing Cervical Fascia

The deep cervical fascia invests the muscles and visceral structures of the neck as laminae loosely bound to each other, so that infections can readily migrate from one site to another. The three primary layers of the deep cervical fascia consist of (1) the investing, (2) the pretracheal, and (3) the prevertebral.

1. The investing layer (deep to the skin and platysma) encloses the musculature (sternocleidomastoid and the trapezius) and submaxillary gland and extends to the lower portion of the parotid gland. Inferiorly it divides into two layers and attaches to the superior border of the manubrium of the sternum.

2. The pretracheal layer encloses the thyroid gland and trachea and forms the anterior portion of the carotid sheath. This fascia also gives rise to the thickened portions that serve as suspensory ligaments of the superomedial portion of the thyroid gland, attaching it firmly to the trachea and cricoid. The pretracheal fascia forms a loose, thin sheath, or false capsule, around the thyroid gland.

3. The prevertebral fascia, thicker than the pretracheal, forms the posterior part of the carotid sheath, covers the phrenic nerve and prevertebral muscles, and passes behind the pharynx onto the cervical vertebrae. It is attached to the base of the skull and inferiorly splits to attach by means of one lamina to the posterior pharyngeal wall, while the other lamina passes down into the thorax on the vertebral column. This may affect the subsequent course of an infection following the perforation by an instrument of the posterior pharyngeal or esophageal wall. The phrenic nerve, sympathetic chain, and inferior thyroid and vertebral arteries are firmly bound down by this thickened fascial layer.

Lateral Neck: Surgical Quadrilateral Area

Inasmuch as the major portion of the neurovascular structures of the neck lie beneath the sternocleidomastoid muscle, it is felt that an adequate description of this area cannot be confined to the division into the classic anatomic triangles. From the surgical point of view the neck might be better described as consisting of a lateral quadrilateral and an anterior rhomboid area (Plates 5–2 to 7–3).

The sternocleidomastoid muscle, an important surgical landmark of the neck, because of its width overlies most of the vital structures of the neck i.e., the major portion of the carotid sheath and its contents, the jugular veins, the scalenus anterior muscle and phrenic nerve, the origin of the cervical plexus, part of the brachial plexus, the accessory and