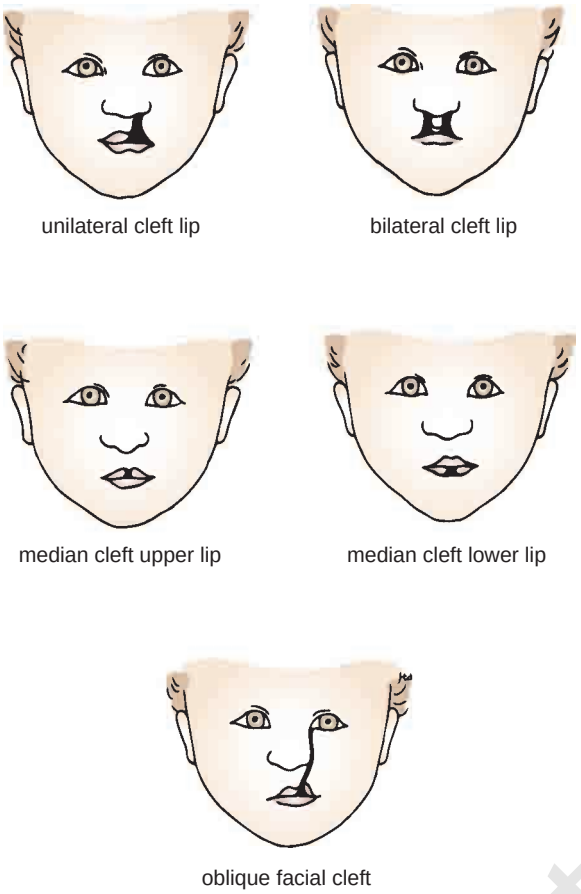


**FIGURE 11.44** Various forms of cleft lip.

## The Neck

The neck is the region of the body that lies between the lower margin of the mandible above and the suprasternal notch and the upper border of the clavicle below. It is strengthened by the cervical part of the vertebral column, which is convex forward and supports the skull. Behind the vertebrae is a mass of extensor muscles and in front is a smaller group of flexor muscles (Fig. 11.49). In the central region of the neck are parts of the respiratory system, namely, the larynx and the trachea, and behind are parts of the alimentary system, the pharynx and the esophagus. At the sides of these structures are the vertically running carotid arteries, internal jugular veins, the vagus nerve, and the deep cervical lymph nodes (Fig. 11.49).

**FIGURE 11.45** Unilateral cleft upper lip. (Courtesy of R. Chase.)

**FIGURE 11.46** Bilateral cleft upper lip and palate. (Courtesy of R. Chase.)

### Skin of the Neck

The natural lines of cleavage of the skin are constant and run almost horizontally around the neck. This is important clinically because an incision along a cleavage line will heal

**FIGURE 11.47** Right-sided oblique facial cleft and left-sided cleft upper lip. There also is total bilateral cleft palate. (Courtesy of R. Chase.)

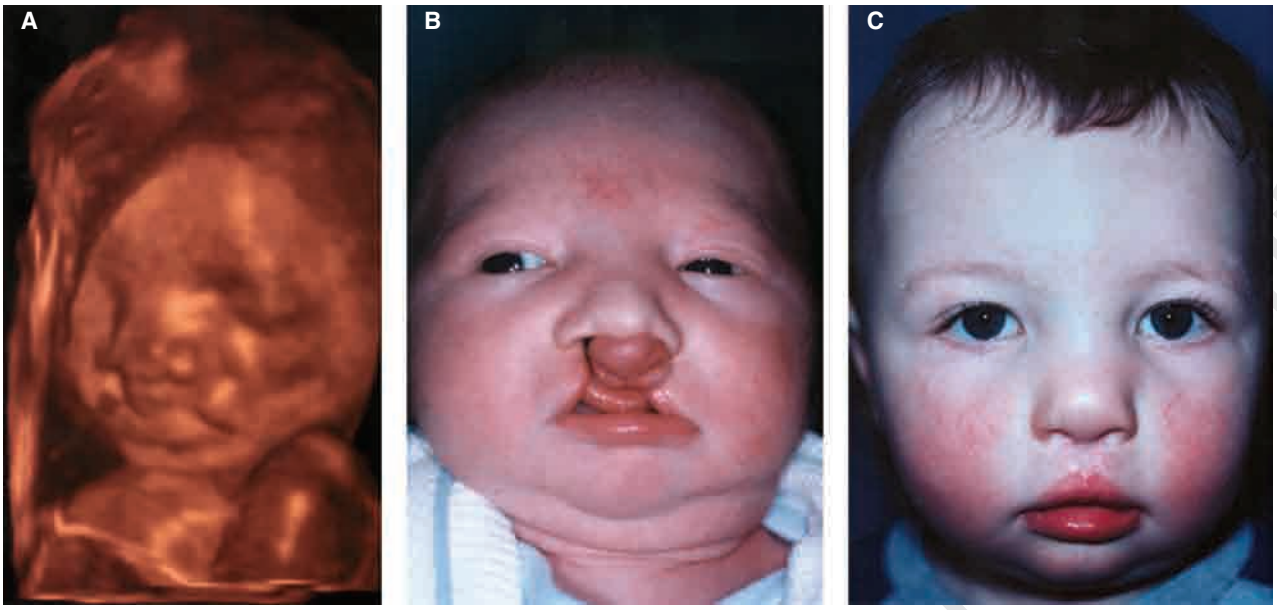


**FIGURE 11.48** Cleft lip and palate. **A.** A three-dimensional ultrasonograph reveals bilateral cleft lip at 22 weeks of gestation. (Courtesy of Dr. B. Benacerraf.) **B.** An infant with bilateral complete cleft lip and palate. **C.** Shows the same child at 18 months of age, after synchronous nasolabial repair and palatal closure performed at a second stage. (Courtesy of Dr. J. B. Mulliken. *N Engl J Med* 351;8:769.)

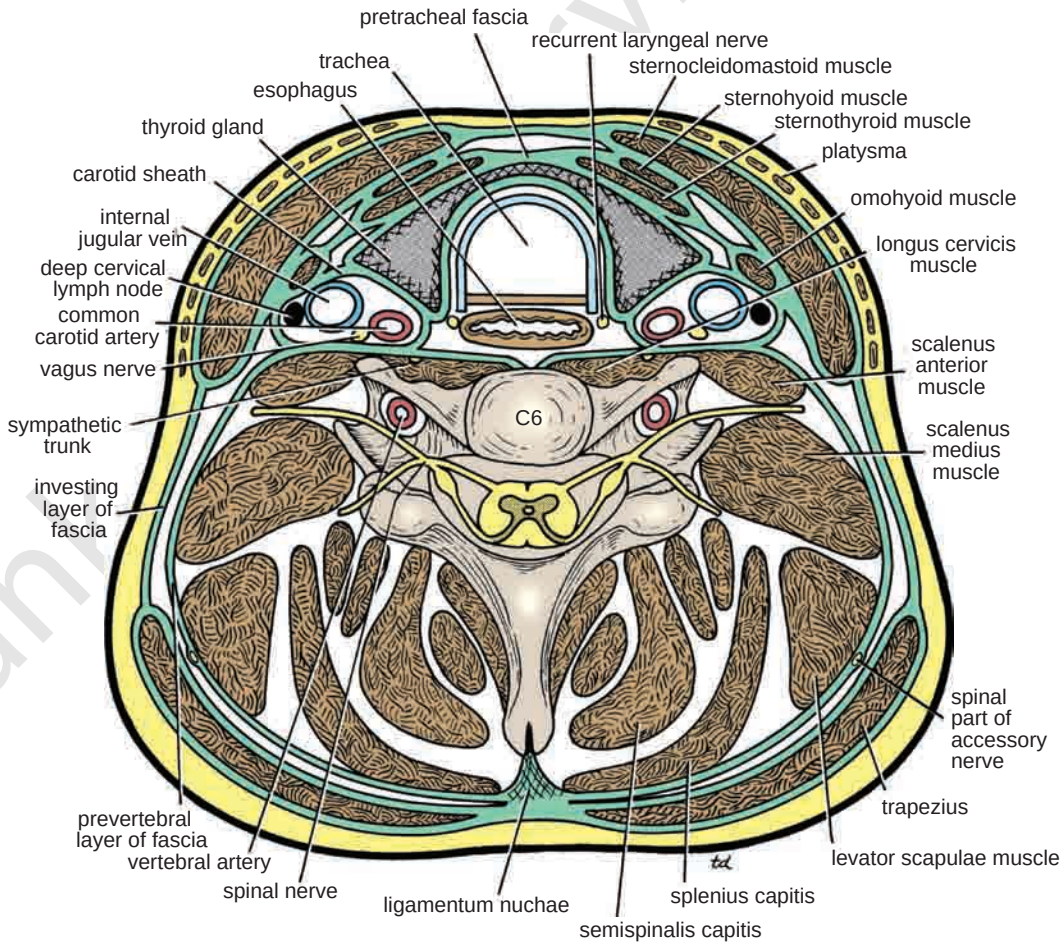


**FIGURE 11.49** Cross section of the neck at the level of the 6th cervical vertebra.

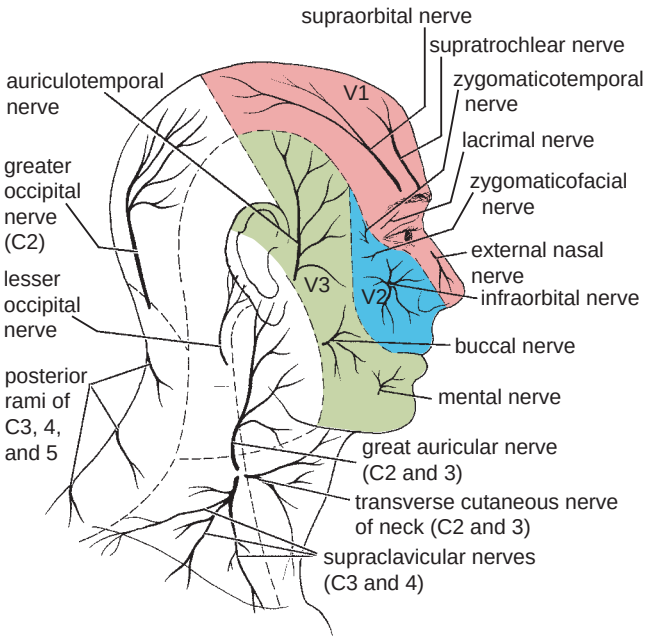


**FIGURE 11.50** Sensory nerve supply to skin of the head and neck. Note that the skin over the angle of the jaw is supplied by the great auricular nerve (C2 and 3) and not by branches of the trigeminal nerve.

as a narrow scar, whereas one that crosses the lines will heal as a wide or heaped-up scar.

### Cutaneous Nerves

The skin overlying the trapezius muscle on the back of the neck and on the back of the scalp as high as the vertex is supplied segmentally by posterior rami of cervical nerves 2 to 5 (Fig. 11.50). The **greater occipital nerve** is a branch of the posterior ramus of the 2nd cervical nerve. The 1st cervical nerve has no cutaneous branch.

The skin of the front and sides of the neck is supplied by anterior rami of cervical nerves 2 to 4 through branches of the cervical plexus. The branches emerge from beneath the posterior border of the sternocleidomastoid muscle (Fig. 11.50).

The **lesser occipital nerve** (C2) hooks around the accessory nerve and ascends along the posterior border of the sternocleidomastoid muscle to supply the skin over the lateral part of the occipital region and the medial surface of the auricle (Fig. 11.50).

The **great auricular nerve** (C2 and 3) ascends across the sternocleidomastoid muscle and divides into branches that supply the skin over the angle of the mandible, the parotid gland, and on both surfaces of the auricle (Fig. 11.50).

The **transverse cutaneous nerve** (C2 and 3) emerges from behind the middle of the posterior border of the sternocleidomastoid muscle. It passes forward across that muscle and divides into branches that supply the skin on the anterior and lateral surfaces of the neck, from the body of the mandible to the sternum (Fig. 11.50).

The **supraclavicular nerves** (C3 and 4) emerge from beneath the posterior border of the sternocleidomastoid muscle and descend across the side of the neck. They pass onto the chest wall and shoulder region, down to the level of the second rib (Fig. 11.50). The **medial supraclavicular nerve** crosses the medial end of the clavicle and supplies the skin as far as the median plane. The **intermediate supraclavicular nerve** crosses the middle of the clavicle and supplies the skin of the chest wall. The **lateral supraclavicular nerve** crosses the lateral end of the clavicle and supplies the skin over the shoulder and the upper half of the deltoid muscle; this nerve also supplies the posterior aspect of the shoulder as far down as the spine of the scapula.

## Superficial Fascia

The superficial fascia of the neck forms a thin layer that encloses the platysma muscle. Also embedded in it are the cutaneous nerves referred to in the previous section, the superficial veins, and the superficial lymph nodes.

### Platysma

The platysma muscle (Figs. 11.38 and 11.51) is a thin but clinically important muscular sheet embedded in the superficial fascia. It is described in Table 11.5, page 589.

### Superficial Veins

#### External Jugular Vein

The external jugular vein begins just behind the angle of the mandible by the union of the posterior auricular vein with the posterior division of the retromandibular vein (Fig. 11.52). It descends obliquely across the sternocleidomastoid muscle and, just above the clavicle in the posterior triangle, pierces the deep fascia and drains into the subclavian vein (Fig. 11.53). It varies considerably in size, and its course extends from the angle of the mandible to the middle of the clavicle.

#### Tributaries

The external jugular vein (Fig. 11.52) has the following tributaries:

- Posterior auricular vein
- Posterior division of the retromandibular vein
- Posterior external jugular vein, a small vein that drains the posterior part of the scalp and neck and joins the external jugular vein about halfway along its course
- Transverse cervical vein
- Suprascapular vein
- Anterior jugular vein

## CLINICAL NOTES

### Visibility of the External Jugular Vein

The external jugular vein is less obvious in children and women because their subcutaneous tissue tends to be thicker than the tissue of men. In obese individuals, the vein may be difficult to identify even when they are asked to hold their breath, which impedes the venous return to the right side of the heart and distends the vein.

The superficial veins of the neck tend to be enlarged and often tortuous in professional singers because of prolonged periods of raised intrathoracic pressure.

### The External Jugular Vein as a Venous Manometer

The external jugular vein serves as a useful venous manometer. Normally, when the patient is lying at a horizontal angle of 30°, the level of the blood in the external jugular veins reaches about one third of the way up the neck. As the patient sits up, the blood level falls until it is no longer visible behind the clavicle.

### External Jugular Vein Catheterization

The external jugular vein can be used for catheterization, but the presence of valves or tortuosity may make the passage of the catheter difficult. Because the right external jugular vein is in the most direct line with the superior vena cava, it is the one most commonly used (Fig. 11.54).

The vein is catheterized about halfway between the level of the cricoid cartilage and the clavicle. The passage of the catheter should be performed during inspiration when the valves are open.

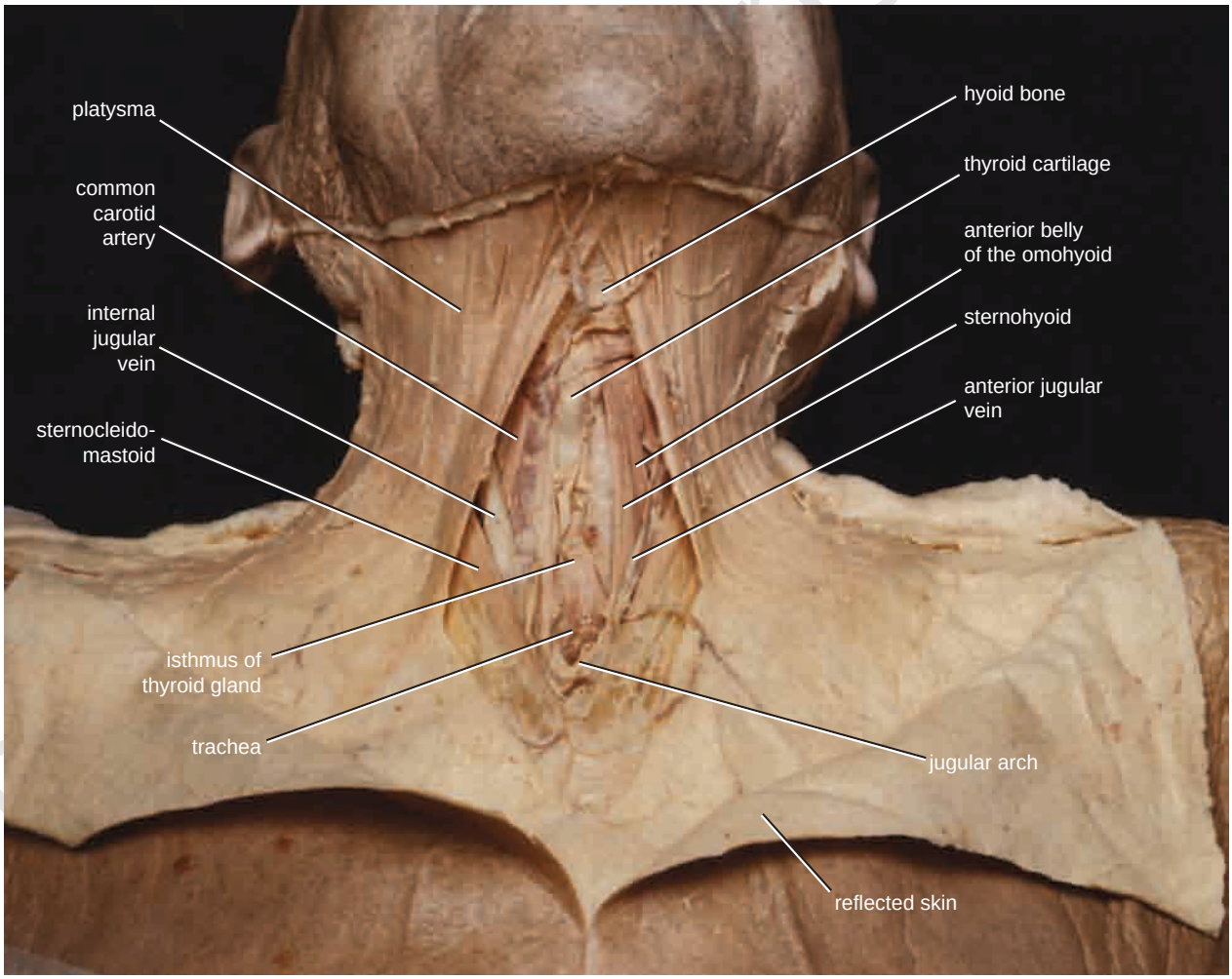


**FIGURE 11.51** Dissection of the anterior aspect of the neck showing the platysma muscles and the lower ends of the sternocleidomastoid muscles on both sides. The skin has been reflected downward.

## TABLE 11.5 Muscles of the Neck

| Muscle | Origin | Insertion | Nerve Supply | Action |
|---|---|---|---|---|
| Platysma | Deep fascia over pectoralis major and deltoid | Body of mandible and angle of mouth | Facial nerve cervical branch | Depresses mandible and angle of mouth |
| Sternocleidomastoid | Manubrium sterni and medial third of clavicle | Mastoid process of temporal bone and occipital bone | Spinal part of accessory nerve and C2 and 3 | Two muscles acting together extend head and flex neck; one muscle rotates head to opposite side |
| Digastric | | | | |
| Posterior belly | Mastoid process of temporal bone | Intermediate tendon is held to hyoid by fascial sling | Facial nerve | Depresses mandible or elevates hyoid bone |
| Anterior belly | Body of mandible | | Nerve to mylohyoid | |
| Stylohyoid | Styloid process | Body of hyoid bone | Facial nerve | Elevates hyoid bone |
| Mylohyoid | Mylohyoid line of body of mandible | Body of hyoid bone and fibrous raphe | Inferior alveolar nerve | Elevates floor of mouth and hyoid bone or depresses mandible |
| Geniohyoid | Inferior mental spine of mandible | Body of hyoid bone | 1st cervical nerve | Elevates hyoid bone or depresses mandible |
| Sternohyoid | Manubrium sterni and clavicle | Body of hyoid bone | Ansa cervicalis; C1, 2, and 3 | Depresses hyoid bone |
| Sternothyroid | Manubrium sterni | Oblique line on lamina of thyroid cartilage | Ansa cervicalis; C1, 2, and 3 | Depresses larynx |
| Thyrohyoid | Oblique line on lamina of thyroid cartilage | Lower border of body of hyoid bone | 1st cervical nerve | Depresses hyoid bone or elevates larynx |
| Omohyoid | | | | |
| Inferior belly | Upper margin of scapula and suprascapular ligament | Intermediate tendon is held to clavicle and first rib by fascial sling | Ansa cervicalis; C1, 2, and 3 | Depresses hyoid bone |
| Superior belly | Lower border of body of hyoid bone | | | |
| Scalenus anterior | Transverse processes of 3rd, 4th, 5th, and 6th cervical vertebrae | 1st rib | C4, 5, and 6 | Elevates 1st rib; laterally flexes and rotates cervical part of vertebral column |
| Scalenus medius | Transverse processes of upper six cervical vertebrae | 1st rib | Anterior rami of cervical nerves | Elevates 1st rib; laterally flexes and rotates cervical part of vertebral column |
| Scalenus posterior | Transverse processes of lower cervical vertebrae | 2nd rib | Anterior rami of cervical nerves | Elevates 2nd rib; laterally flexes and rotates cervical part of vertebral column |

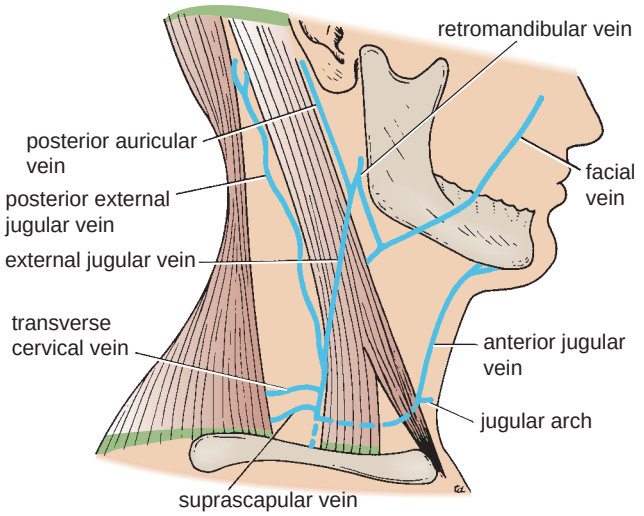


**FIGURE 11.52** Major superficial veins of the face and neck.

### Anterior Jugular Vein

The anterior jugular vein begins just below the chin, by the union of several small veins (Fig. 11.52). It runs down the neck close to the midline. Just above the suprasternal notch, the veins of the two sides are united by a transverse trunk called the **jugular arch**. The vein then turns sharply laterally and passes deep to the sternocleidomastoid muscle to drain into the external jugular vein.

### Superficial Lymph Nodes

The superficial cervical lymph nodes lie along the external jugular vein superficial to the sternocleidomastoid muscle (Fig. 11.40). They receive lymph vessels from the occipital and mastoid lymph nodes (see page 604) and drain into the deep cervical lymph nodes.

## Bones of the Neck

### Cervical Vertebrae

The cervical part of the vertebral column is described on page 686.

### Hyoid Bone

The hyoid bone is a mobile single bone found in the midline of the neck below the mandible and abides the larynx. It does not articulate with any other bones. The hyoid bone is U shaped and consists of a body and two greater and two lesser cornua (Fig. 11.32). It is attached to the skull by the stylohyoid ligament and to the thyroid cartilage by the thyrohyoid

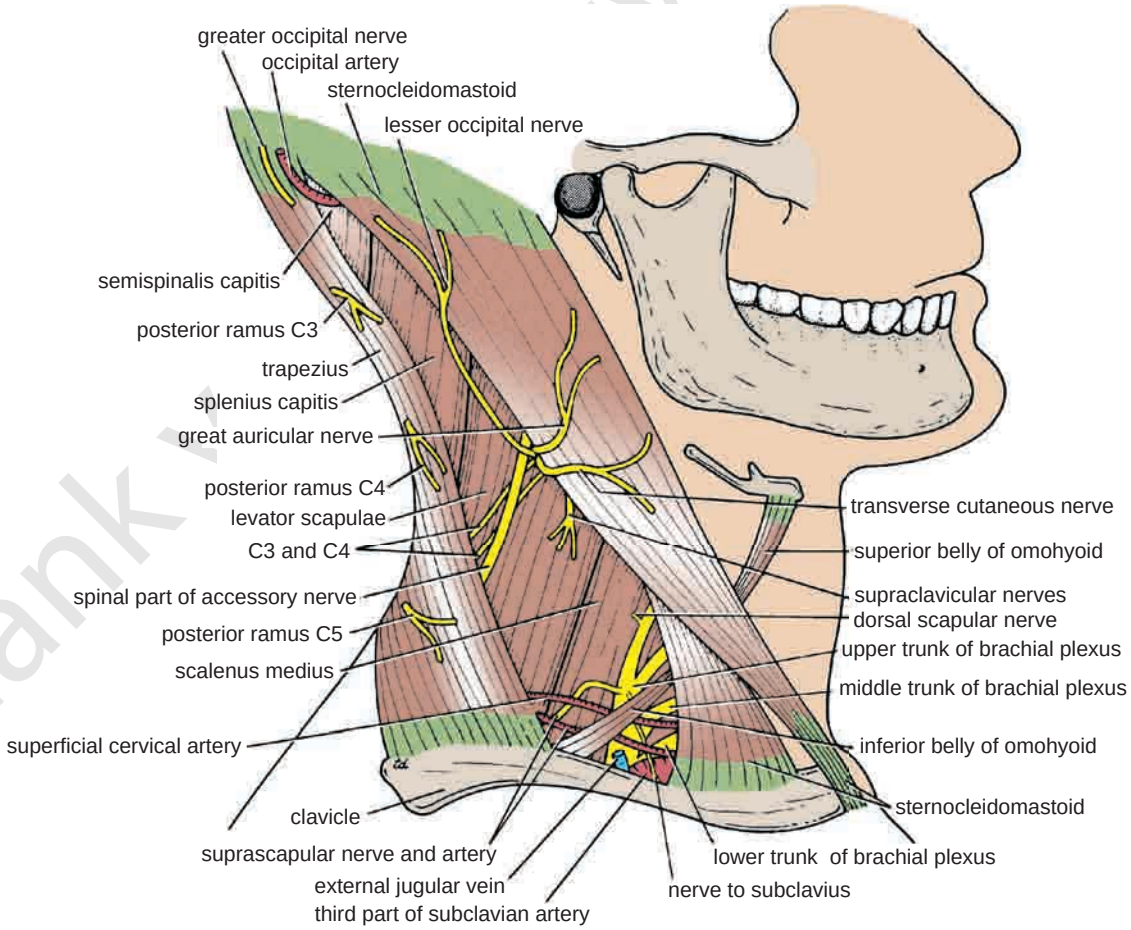


**FIGURE 11.53** Posterior triangle of the neck.

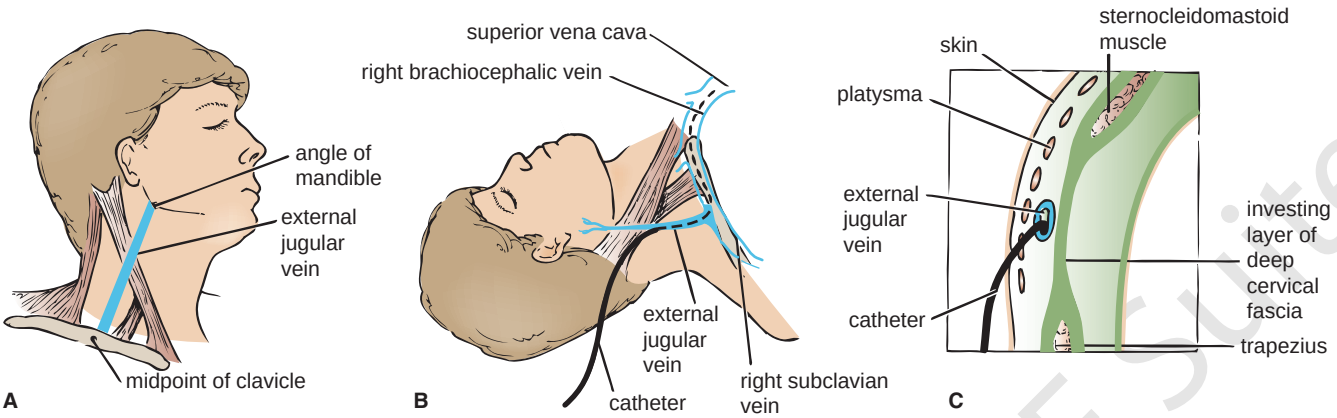


**FIGURE 11.54** Catheterization of the right external jugular vein. **A.** Surface marking of the vein. **B.** Site of catheterization. Note how the external jugular vein joins the subclavian vein at a right angle. **C.** Cross section of the neck showing the relationships of the external jugular vein as it crosses the posterior triangle of the neck.

membrane. The hyoid bone forms a base for the tongue and is suspended in position by muscles that connect it to the mandible, to the styloid process of the temporal bone, to the thyroid cartilage, to the sternum, and to the scapula.

The important muscles attached to the hyoid bone are shown in Figure 11.32.

## Muscles of the Neck

The superficial muscles of the side of the neck (Figs. 11.38 and 11.51) are described in Table 11.5. The suprahyoid and infrahyoid muscles and the anterior and lateral vertebral muscles are also described in Table 11.5.

### CLINICAL NOTES

#### Clinical Identification of the Platysma

The platysma can be seen as a thin sheet of muscle just beneath the skin by having the patient clench his or her jaws firmly. The muscle extends from the body of the mandible downward over the clavicle onto the anterior chest wall.

#### Platysma Tone and Neck Incisions

In lacerations or surgical incisions in the neck, it is very important that the subcutaneous layer with the platysma be carefully sutured, since the tone of the platysma can pull on the scar tissue, resulting in broad, unsightly scars.

#### Platysma Innervation, Mouth Distortion, and Neck Incisions

The platysma muscle is innervated by the cervical branch of the facial nerve. This nerve emerges from the lower end of the parotid gland and travels forward to the platysma; it then sometimes crosses the lower border of the mandible to supply the depressor anguli oris muscle (see page XXX). Skin lacerations over the mandible or upper part of the neck may distort the shape of the mouth.

## Key Neck Muscles

### Sternocleidomastoid Muscle

When the sternocleidomastoid muscle (Figs. 11.51, 11.53, and 11.55) contracts, it appears as an oblique band crossing the side of the neck from the sternoclavicular joint to the mastoid process of the skull. It divides the neck into anterior and posterior triangles (Fig. 11.56). The anterior border covers the carotid arteries, the internal jugular vein, and the deep cervical lymph nodes; it also overlaps the thyroid gland. The muscle is covered superficially by skin, fascia, the platysma muscle, and the external jugular vein. The deep surface of the posterior border is related to the cervical plexus of nerves, the phrenic nerve, and the upper part of the brachial plexus. The origin, insertion, nerve supply, and action of the sternocleidomastoid muscle are summarized in Table 11.5.

### CLINICAL NOTES

#### Sternocleidomastoid Muscle and Protection from Trauma

The sternocleidomastoid, a strong, thick muscle crossing the side of the neck, protects the underlying soft structures from blunt trauma. Suicide attempts by cutting one's throat often fail because the individual first extends the neck before making several horizontal cuts with a knife. Extension of the cervical part of the vertebral column and extension of the head at the atlantooccipital joint cause the carotid sheath with its contained large blood vessels to slide posteriorly beneath the sternocleidomastoid muscle. To achieve the desired result with the head and neck fully extended, some individuals have to make several attempts and only succeed when the larynx and the greater part of the sternocleidomastoid muscles have been severed. The common sites for the wounds are immediately above and below the hyoid bone.

*(continued)*

### Congenital Torticollis

Most cases of congenital torticollis are a result of excessive stretching of the sternocleidomastoid muscle during a difficult labor. Hemorrhage occurs into the muscle and may be detected as a small, rounded "tumor" during the early weeks after birth. Later, this becomes invaded by fibrous tissue, which contracts and shortens the muscle. The mastoid process is thus pulled down toward the sternoclavicular joint of the same side, the cervical spine is flexed, and the face looks upward to the opposite side. If left untreated, asymmetrical growth changes occur in the face, and the cervical vertebrae may become wedge shaped.

### Spasmodic Torticollis

Spasmodic torticollis, which results from repeated chronic contractions of the sternocleidomastoid and trapezius muscles, is usually psychogenic in origin. Section of the spinal part of the accessory nerve may be necessary in severe cases.

## Scalenus Anterior Muscle

The scalenus anterior muscle is a key muscle in understanding the root of the neck (Fig. 11.57). It is deeply placed and it descends almost vertically from the vertebral column to the 1st rib.

**Important Relations**

- **Anteriorly:** Related to the carotid arteries, the vagus nerve, the internal jugular vein, and the deep cervical lymph nodes (Fig. 11.49). The transverse cervical and suprascapular arteries and the prevertebral layer of deep cervical fascia bind the phrenic nerve to the muscle.
- **Posteriorly:** Related to the pleura, the origin of the brachial plexus, and the second part of the subclavian artery (Fig. 11.57). The scalenus medius muscle lies behind the scalenus anterior muscle.
- **Medially:** Related to the vertebral artery and vein and the sympathetic trunk (Fig. 11.57). On the left side, the medial border is related to the thoracic duct.

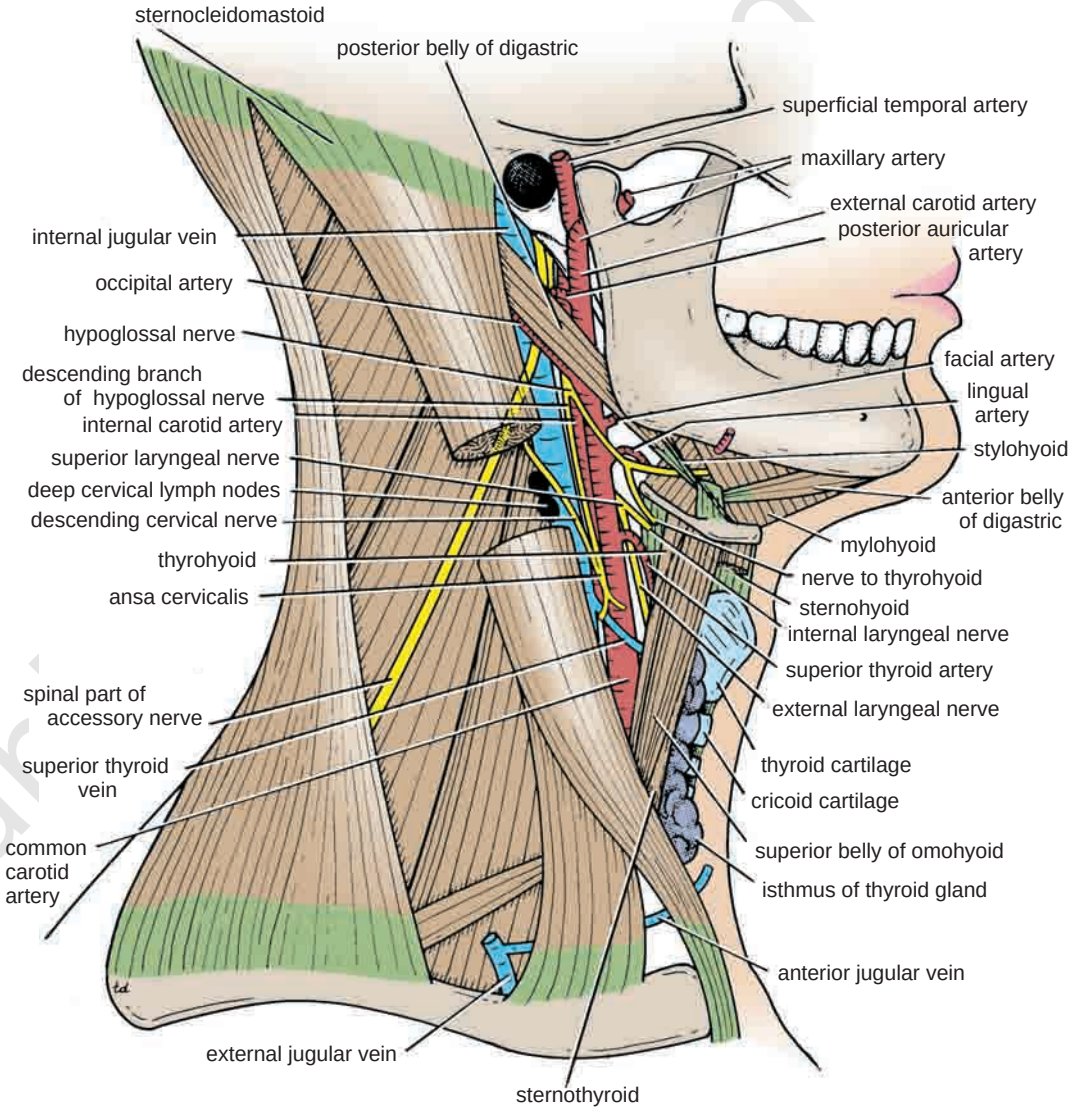


**FIGURE 11.55** Anterior triangle of the neck.

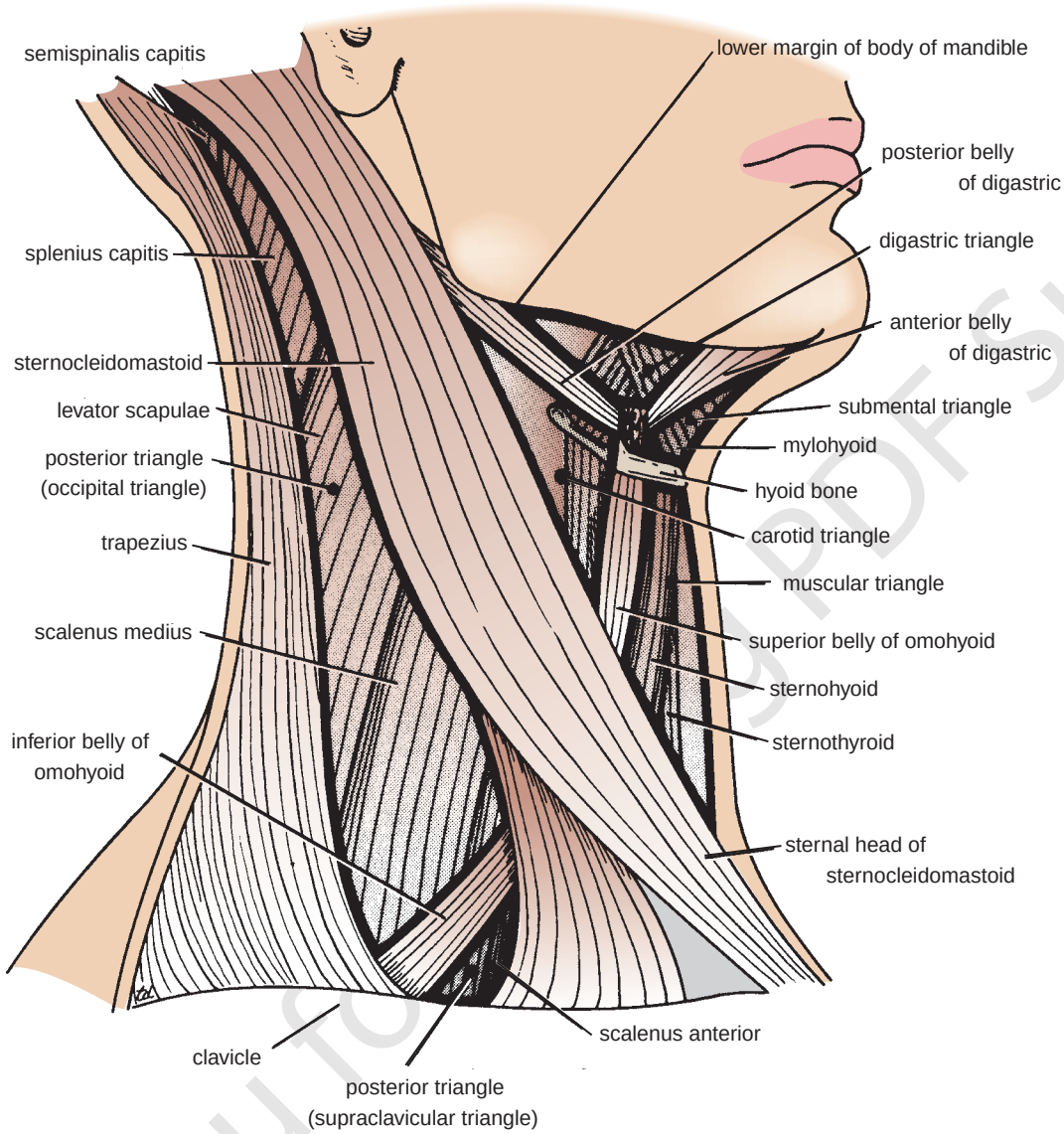


**FIGURE 11.56** Muscular triangles of the neck.

- **Laterally:** Related to the emerging branches of the cervical plexus, the roots of the brachial plexus, and the third part of the subclavian artery (Fig. 11.57).

The origin, insertion, nerve supply, and action of the scalenus anterior muscle are summarized in Table 11.5.

## Deep Cervical Fascia

The deep cervical fascia supports the muscles, the vessels, and the viscera of the neck (Fig. 11.49). In certain areas, it is condensed to form well-defined, fibrous sheets called the **investing layer,** the **pretracheal layer,** and the **prevertebral layer.** It is also condensed to form the carotid sheath (Fig. 11.49).

### Investing Layer

The investing layer is a thick layer that encircles the neck. It splits to enclose the trapezius and the sternocleidomastoid muscles (Fig. 11.49).

### Pretracheal Layer

The pretracheal layer is a thin layer that is attached above to the laryngeal cartilages (Fig. 11.49). It surrounds the thyroid and the parathyroid glands, forming a sheath for them, and encloses the infrahyoid muscles.

### Prevertebral Layer

The prevertebral layer is a thick layer that passes like a septum across the neck behind the pharynx and the esophagus and in front of the prevertebral muscles and the vertebral column (Fig. 11.49). It forms the fascial floor of the posterior triangle, and it extends laterally over the first rib into the axilla to form the important **axillary sheath** (see page 596).

### Carotid Sheath

The carotid sheath is a local condensation of the prevertebral, the pretracheal, and the investing layers of the deep

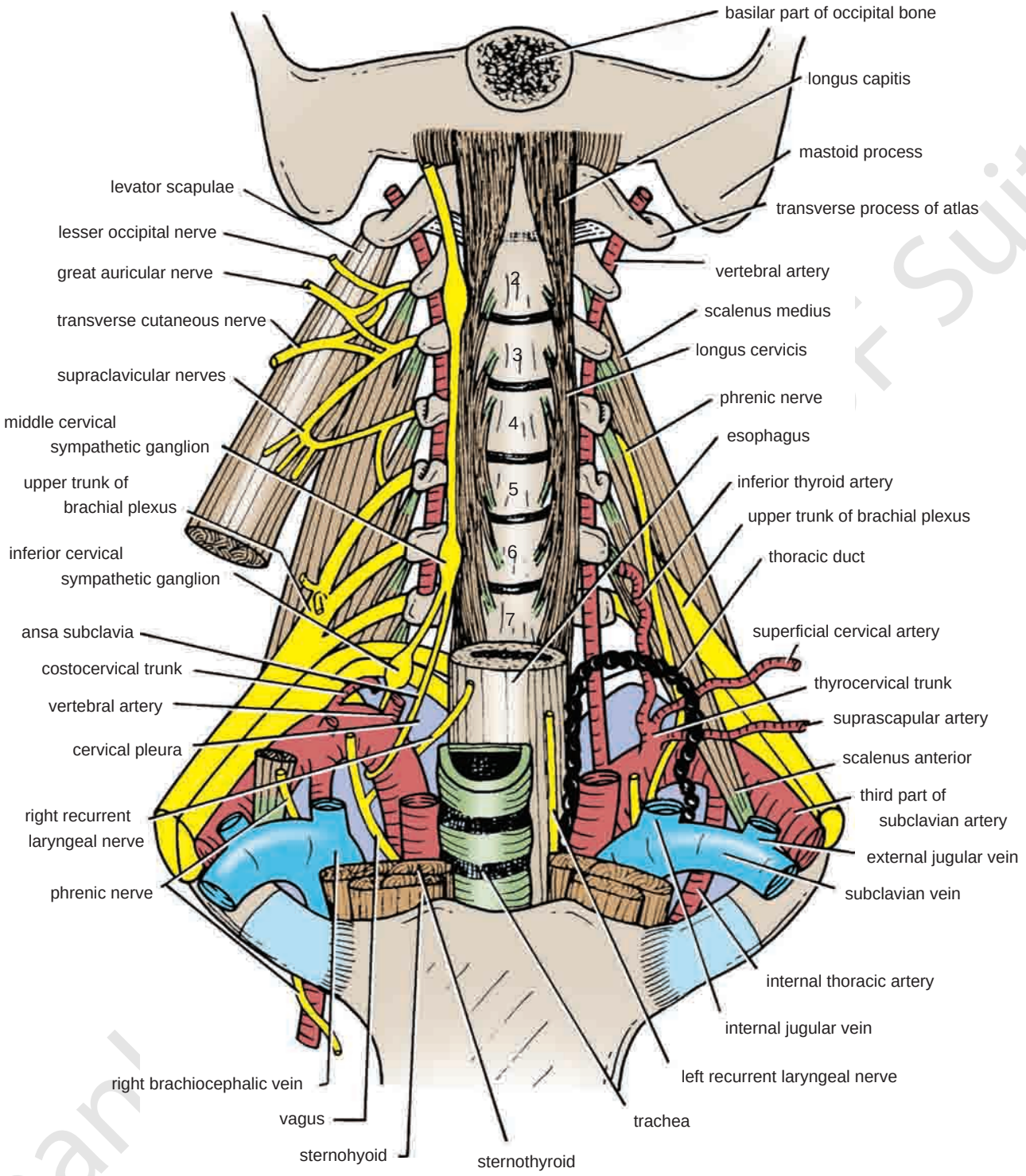


**FIGURE 11.57** Prevertebral region and the root of the neck.

## CLINICAL NOTES

### Clinical Significance of the Deep Fascia of the Neck

As previously described, the deep fascia in certain areas forms distinct sheets called the **investing, pretracheal,** and **prevertebral** layers. These fascial layers are easily recognizable to the surgeon at operation.

#### Fascial Spaces

Between the more dense layers of deep fascia in the neck is loose connective tissue that forms potential spaces that are clinically important. Among the more important spaces are the visceral, retropharyngeal, submandibular, and masticatory spaces (Fig. 11.58).

The deep fascia and the fascial spaces are important because organisms originating in the mouth, teeth, pharynx, and esophagus can spread among the fascial planes and spaces, and the tough fascia can determine the direction of spread of infection and the path taken by pus. It is possible for blood, pus, or air in the retropharyngeal space to spread downward into the superior mediastinum of the thorax.

#### Acute Infections of the Fascial Spaces of the Neck

**Dental infections** most commonly involve the lower molar teeth. The infection spreads medially from the mandible into the submandibular and masticatory spaces and pushes the tongue forward and upward. Further spread downward may involve the visceral space and lead to edema of the vocal cords and airway obstruction.

**Ludwig's angina** is an acute infection of the submandibular fascial space and is commonly secondary to dental infection.

#### Chronic Infection of the Fascial Spaces of the Neck

**Tuberculous infection of the deep cervical lymph nodes** can result in liquefaction and destruction of one or more of the nodes. The pus is at first limited by the investing layer of the deep fascia. Later, this becomes eroded at one point, and the pus passes into the less restricted superficial fascia. A dumbbell or collar-stud abscess is now present. The clinician is aware of the superficial abscess but must not forget the existence of the deeply placed abscess.

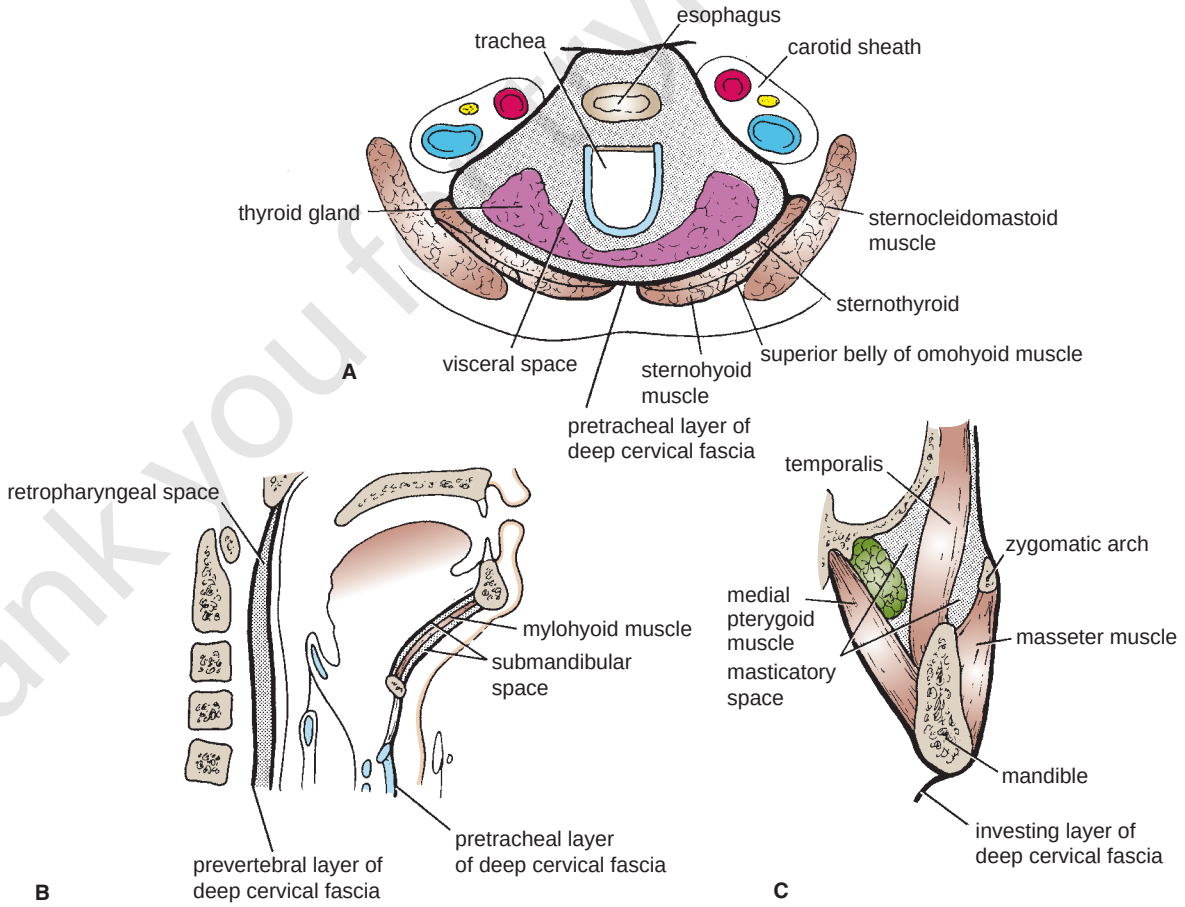


**FIGURE 11.58** **A.** Cross section of the neck showing the visceral space. **B.** Sagittal section of the neck showing the positions of the retropharyngeal and submandibular spaces. **C.** Vertical section of the body of the mandible close to the angle showing the masticatory space.

fascia that surround the common and internal carotid arteries, the internal jugular vein, the vagus nerve, and the deep cervical lymph nodes (Fig. 11.49).

### Axillary Sheath

All the anterior rami of the cervical nerves that emerge in the interval between the scalenus anterior and scalenus medius muscles lie at first deep to the prevertebral fascia. As the subclavian artery and the brachial plexus emerge in the interval between the scalenus anterior and the scalenus medius muscles, they carry with them a sheath of the fascia, which extends into the axilla and is called the **axillary sheath.**

### Cervical Ligaments

**Stylohyoid ligament:** Connects the styloid process to the lesser cornu of the hyoid bone (Fig. 11.80)

**Stylomandibular ligament:** Connects the styloid process to the angle of the mandible (Fig. 11.33)

**Sphenomandibular ligament:** Connects the spine of the sphenoid bone to the lingula of the mandible (Fig. 11.33)

**Pterygomandibular ligament:** Connects the hamular process of the medial pterygoid plate to the posterior end of the mylohyoid line of the mandible. It gives attachment to the superior constrictor and the buccinator muscles (Fig. 11.80).

## Muscular Triangles of the Neck

The sternocleidomastoid muscle divides the neck into the anterior and the posterior triangles (Fig. 11.56).

### Anterior Triangle

The anterior triangle is bounded above by the body of the mandible, posteriorly by the sternocleidomastoid muscle, and anteriorly by the midline (Fig. 11.56). It is further subdivided into the **carotid triangle,** the **digastric triangle,** the **submental triangle,** and the **muscular triangle** (Fig. 11.56).

### Posterior Triangle

The posterior triangle is bounded posteriorly by the trapezius muscle, anteriorly by the sternocleidomastoid muscle, and inferiorly by the clavicle (Fig. 11.56). The posterior triangle of the neck is further subdivided by the **inferior belly of the omohyoid muscle** into a large **occipital triangle** above and a small **supraclavicular triangle** below (Fig. 11.56).

The suprahyoid and infrahyoid muscles and the anterior and lateral vertebral muscles are described in Table 11.5.

## Arteries of the Head and Neck

### Common Carotid Artery

The right common carotid artery arises from the brachiocephalic artery behind the right sternoclavicular joint (Figs. 11.57 and 11.59). The left artery arises from the arch of the aorta in the superior mediastinum (see page 95). The common carotid artery runs upward through the neck under cover of the anterior border of the sternocleidomastoid muscle, from the sternoclavicular joint to the upper border of the thyroid cartilage. Here, it divides into the external and internal carotid arteries (Figs. 11.55 and 11.60).

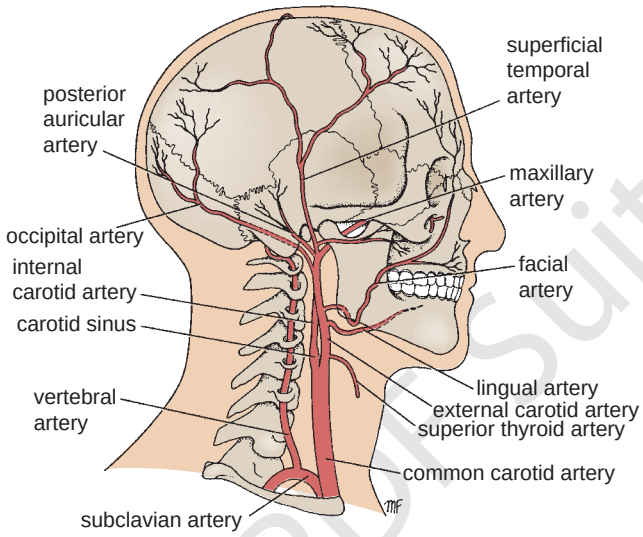


**FIGURE 11.59** Main arteries of the head and neck. Note that for clarity the thyrocervical trunk, the costocervical trunk, and the internal thoracic artery—branches of the subclavian artery—are not shown.

### Carotid Sinus

At its point of division, the terminal part of the common carotid artery or the beginning of the internal carotid artery shows a localized dilatation, called the **carotid sinus** (Fig. 11.60). The tunica media of the sinus is thinner than elsewhere, but the adventitia is relatively thick and contains numerous nerve endings derived from the glossopharyngeal nerve. The carotid sinus serves as a reflex pressoreceptor mechanism: A rise in blood pressure causes a slowing of the heart rate and vasodilatation of the arterioles.

**CLINICAL NOTES**

**Carotid Sinus Hypersensitivity**

In cases of carotid sinus hypersensitivity, pressure on one or both carotid sinuses can cause excessive slowing of the heart rate, a fall in blood pressure, and cerebral ischemia with fainting.

### Carotid Body

The carotid body is a small structure that lies posterior to the point of bifurcation of the common carotid artery (Fig. 11.60). It is innervated by the glossopharyngeal nerve. The carotid body is a chemoreceptor, being sensitive to excess carbon dioxide and reduced oxygen tension in the blood. Such a stimulus reflexly produces a rise in blood pressure and heart rate and an increase in respiratory movements.

The common carotid artery is embedded in a connective tissue sheath, called the carotid sheath, throughout its course and is closely related to the internal jugular vein and vagus nerve (Fig. 11.49).

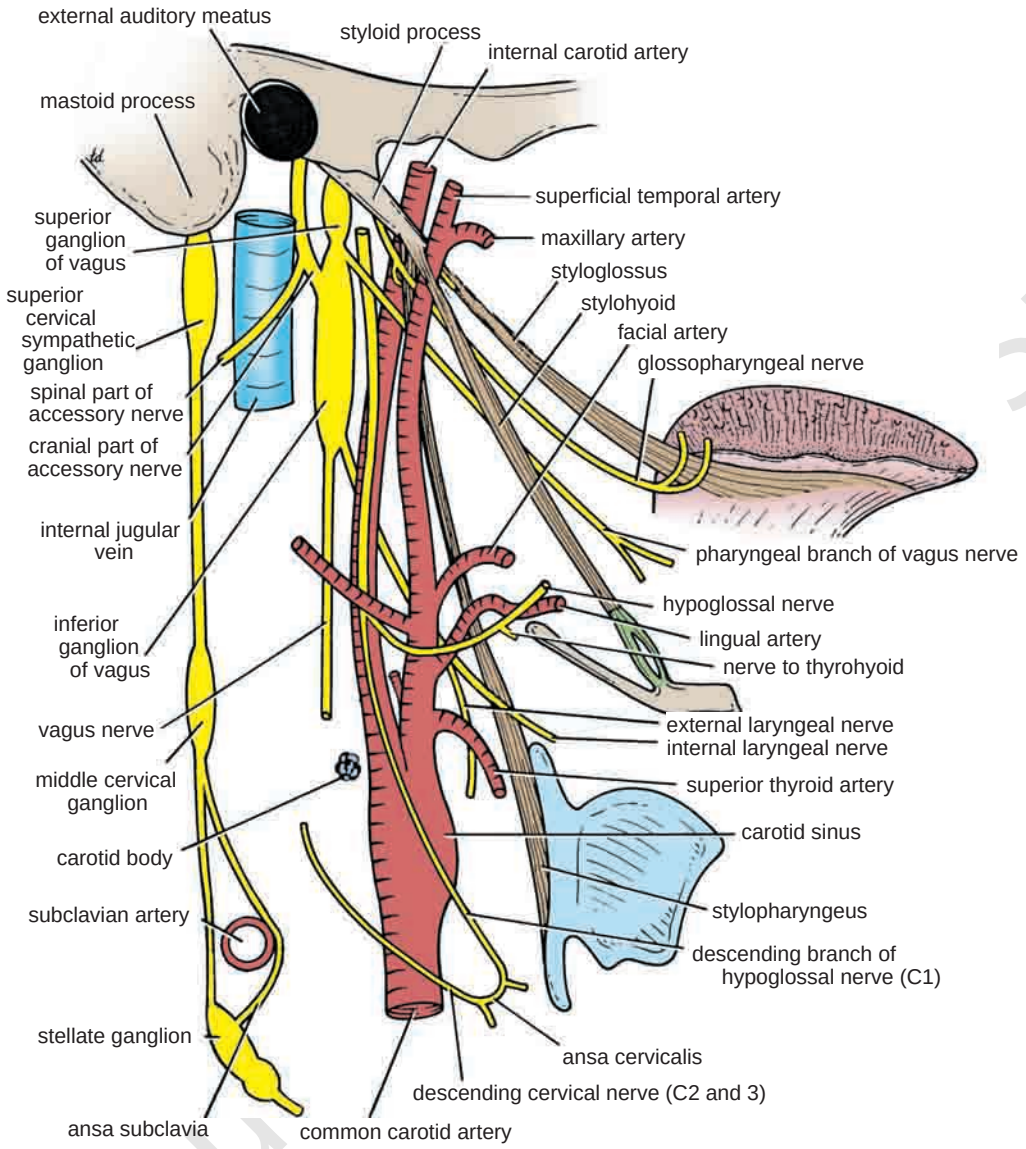


**FIGURE 11.60** Styloid muscles, vessels, and nerves of the neck.

### Relations of the Common Carotid Artery

- **Anterolaterally:** The skin, the fascia, the sternocleidomastoid, the sternohyoid, the sternothyroid, and the superior belly of the omohyoid (Fig. 11.55)
- **Posteriorly:** The transverse processes of the lower four cervical vertebrae, the prevertebral muscles, and the sympathetic trunk (Fig. 11.57). In the lower part of the neck are the vertebral vessels.
- **Medially:** The larynx and pharynx and, below these, the trachea and esophagus (Fig. 11.49). The lobe of the thyroid gland also lies medially.
- **Laterally:** The internal jugular vein and, posterolaterally, the vagus nerve (Fig. 11.49).

### Branches of the Common Carotid Artery

Apart from the two terminal branches, the common carotid artery gives off no branches.

**CLINICAL NOTES**

**Taking the Carotid Pulse**

The bifurcation of the common carotid artery into the internal and external carotid arteries can be easily palpated just beneath the anterior border of the sternocleidomastoid muscle at the level of the superior border of the thyroid cartilage. This is a convenient site to take the carotid pulse.

## External Carotid Artery

The external carotid artery is one of the terminal branches of the common carotid artery (Fig. 11.59). It supplies structures in the neck, face, and scalp; it also supplies the tongue

and the maxilla. The artery begins at the level of the upper border of the thyroid cartilage and terminates in the substance of the parotid gland behind the neck of the mandible by dividing into the superficial temporal and maxillary arteries.

Close to its origin, the artery emerges from undercover of the sternocleidomastoid muscle, where its pulsations can be felt. At first, it lies medial to the internal carotid artery, but as it ascends in the neck, it passes backward and lateral to it. It is crossed by the posterior belly of the digastric and the stylohyoid (Fig. 11.55).

### Relations of the External Carotid Artery

- **Anterolaterally:** The artery is overlapped at its beginning by the anterior border of the sternocleidomastoid. Above this level, the artery is comparatively superficial, being covered by skin and fascia. It is crossed by the hypoglossal nerve (Fig. 11.55), the posterior belly of the digastric muscle, and the stylohyoid muscles. Within the parotid gland, it is crossed by the facial nerve (Fig. 11.85). The internal jugular vein first lies lateral to the artery and then posterior to it.
- **Medially:** The wall of the pharynx and the internal carotid artery. The stylopharyngeus muscle, the glossopharyngeal nerve, and the pharyngeal branch of the vagus pass between the external and internal carotid arteries (Fig. 11.60).

For the relations of the external carotid artery in the parotid gland, see Figure 11.85B.

### Branches of the External Carotid Artery

- Superior thyroid artery
- Ascending pharyngeal artery
- Lingual artery
- Facial artery
- Occipital artery
- Posterior auricular artery
- Superficial temporal artery
- Maxillary artery

#### Superior Thyroid Artery

The superior thyroid artery curves downward to the upper pole of the thyroid gland (Figs. 11.55 and 11.60). It is accompanied by the external laryngeal nerve, which supplies the cricothyroid muscle.

#### Ascending Pharyngeal Artery

The ascending pharyngeal artery ascends along and supplies the pharyngeal wall.

#### Lingual Artery

The lingual artery loops upward and forward and supplies the tongue (Figs. 11.55 and 11.60).

#### Facial Artery

The facial artery loops upward close to the outer surface of the pharynx and the tonsil. It lies deep to the submandibular salivary gland and emerges and bends around the lower border of the mandible. It then ascends over the face close to the anterior border of the masseter muscle. The artery then ascends around the lateral margin of the mouth and terminates at the medial angle of the eye (Figs. 11.55 and 11.59).

**Branches of the facial artery** supply the tonsil, the submandibular salivary gland, and the muscles and the skin of the face.

#### Occipital Artery

The artery supplies the back of the scalp (Fig. 11.59).

#### Posterior Auricular Artery

The posterior auricular artery supplies the auricle and the scalp (Fig. 11.59).

#### Superficial Temporal Artery

The superficial temporal artery ascends over the zygomatic arch, where it may be palpated just in front of the auricle (Fig. 11.59). It is accompanied by the auriculotemporal nerve, and it supplies the scalp.

#### Maxillary Artery

The maxillary artery runs forward medial to the neck of the mandible (Fig. 11.59) and enters the pterygopalatine fossa of the skull.

### Branches of the Maxillary Artery

Branches supply the upper and the lower jaws, the muscles of mastication, the nose, the palate, and the meninges inside the skull.

#### Middle Meningeal Artery

The middle meningeal artery enters the skull through the foramen spinosum (Fig. 11.66). It runs laterally within the skull and divides into anterior and posterior branches (Figs. 11.20 and 11.131). The anterior branch is important because it lies close to the motor area of the cerebral cortex of the brain. Accompanied by its vein, it grooves (or tunnels) through the upper part of the greater wing of the sphenoid bone of the skull and the thin anteroinferior angle of the parietal bone, where it is prone to damage after a blow to the head.

The origin and distribution of the branches of the external carotid artery are shown in Figure 11.59.

#### Internal Carotid Artery

The internal carotid artery begins at the bifurcation of the common carotid artery at the level of the upper border of the thyroid cartilage (Figs. 11.55 and 11.59). It supplies the brain, the eye, the forehead, and part of the nose. The artery ascends in the neck embedded in the carotid sheath with the internal jugular vein and vagus nerve. At first it lies superficially; it then passes deep to the parotid salivary gland (Figs. 11.60 and 11.85B).

The internal carotid artery leaves the neck by passing into the cranial cavity through the carotid canal in the petrous part of the temporal bone. It then passes upward and forward in the cavernous venous sinus (without communicating with it). The artery then leaves the sinus and passes upward again medial to the anterior clinoid process of the sphenoid bone. The internal carotid artery then inclines backward, lateral to the optic chiasma, and terminates by dividing into the anterior and the middle cerebral arteries.

### Relations of the Internal Carotid Artery in the Neck

- **Anterolaterally: Below the digastric** lie the skin, the fascia, the anterior border of the sternocleidomastoid, and the hypoglossal nerve (Fig. 11.55). **Above the digastric** lie the stylohyoid muscle, the stylopharyngeus muscle, the glossopharyngeal nerve, the pharyngeal branch of the vagus, the parotid gland, and the external carotid artery (Figs. 11.60 and 11.85B).
- **Posteriorly:** The sympathetic trunk (Fig. 11.60), the longus capitis muscle, and the transverse processes of the upper three cervical vertebrae
- **Medially:** The pharyngeal wall and the superior laryngeal nerve
- **Laterally:** The internal jugular vein and the vagus nerve

**CLINICAL NOTES**

**Arteriosclerosis of the Internal Carotid Artery**

Extensive arteriosclerosis of the internal carotid artery in the neck can cause visual impairment or blindness in the eye on the side of the lesion because of insufficient blood flow through the retinal artery. Motor paralysis and sensory loss may also occur on the opposite side of the body because of insufficient blood flow through the middle cerebral artery.

### Branches of the Internal Carotid Artery

There are no branches in the neck. Many important branches, however, are given off in the skull.

## Ophthalmic Artery

The ophthalmic artery arises from the internal carotid artery as it emerges from the cavernous sinus (Fig. 11.20). It passes forward into the orbital cavity through the optic canal, and it gives off the central artery of the retina, which enters the optic nerve and runs forward to enter the eyeball. The central artery is an end artery and the only blood supply to the retina.

## Posterior Communicating Artery

The posterior communicating artery runs backward to join the posterior cerebral artery (Fig. 11.15).

## Anterior Cerebral Artery

The anterior cerebral artery is a terminal branch of the internal carotid artery (Fig. 11.15). It passes forward between the cerebral hemispheres and then winds around the corpus callosum of the brain to supply the medial and the superolateral surfaces of the cerebral hemisphere. It is joined to the artery of the opposite side by the **anterior communicating artery.**

## Middle Cerebral Artery

The middle cerebral artery is the largest terminal branch of the internal carotid artery (Fig. 11.15), and it runs laterally in the lateral cerebral sulcus of the brain. It supplies the entire lateral surface of the cerebral hemisphere except the narrow strip along the superolateral margin (which is supplied by the anterior cerebral artery) and the occipital pole and inferolateral surface of the hemisphere (both of which are supplied by the posterior cerebral artery). The middle cerebral artery thus supplies all the motor area of the cerebral cortex except the leg area. It also gives off central branches that supply central masses of gray matter and the internal capsule of the brain.

## Circle of Willis

The circle of Willis lies in the subarachnoid space (see page 543) at the base of the brain. It is formed by the anastomosis between the branches of the two internal carotid arteries and the two vertebral arteries (Fig. 11.15). The anterior communicating, posterior cerebral, and basilar (formed by the junction of the two vertebral arteries) are all arteries that contribute to the circle. Cortical and central branches arise from the circle and supply the brain.

## Subclavian Arteries

### Right Subclavian Artery

The right subclavian artery arises from the brachiocephalic artery, behind the right sternoclavicular joint (Figs. 11.57 and 11.59). It arches upward and laterally over the pleura and between the scalenus anterior and medius muscles. At the outer border of the 1st rib, it becomes the axillary artery.

### Left Subclavian Artery

The left subclavian artery arises from the arch of the aorta in the thorax. It ascends to the root of the neck and then arches laterally in a manner similar to that of the right subclavian artery (Fig. 11.57).

The scalenus anterior muscle passes anterior to the artery on each side and divides it into three parts.

### First Part of the Subclavian Artery

The first part of the subclavian artery extends from the origin of the subclavian artery to the medial border of the scalenus anterior muscle (Fig. 11.57). This part gives off the vertebral artery, the thyrocervical trunk, and the internal thoracic artery.

**Branches** The **vertebral artery** ascends in the neck through the foramina in the transverse processes of the upper six cervical vertebrae (Fig. 11.57). It passes medially above the posterior arch of the atlas and then ascends through the foramen magnum into the skull. On reaching the anterior surface of the medulla oblongata of the brain at the level of the lower border of the pons, it joins the vessel of the opposite side to form the basilar artery.

The **basilar artery** (Fig. 11.15) ascends in a groove on the anterior surface of the pons. It gives off branches to the pons, the cerebellum, and the internal ear. It finally divides into the two posterior cerebral arteries.

On each side, the **posterior cerebral artery** (Fig. 11.15) curves laterally and backward around the midbrain. Cortical branches supply the inferolateral surfaces of the temporal lobe and the visual cortex on the lateral and the medial surfaces of the occipital lobe.

**Branches in the neck:** Spinal and muscular arteries
**Branches in the skull:** Meningeal, anterior and posterior spinal, posterior inferior cerebellar, medullary arteries

The **thyrocervical trunk** is a short trunk that gives off three terminal branches (Fig. 11.57).

The **inferior thyroid artery** ascends to the posterior surface of the thyroid gland, where it is closely related to the recurrent laryngeal nerve. It supplies the thyroid and the inferior parathyroid glands.

The **superficial cervical artery** is a small branch that crosses the brachial plexus (Fig. 11.57).

The **suprascapular artery** runs laterally over the brachial plexus and follows the suprascapular nerve onto the back of the scapula (Fig. 11.57).

The **internal thoracic artery** descends into the thorax behind the 1st costal cartilage and in front of the pleura (Fig. 11.57). It descends vertically one fingerbreadth lateral to the sternum; in the 6th intercostal space, it divides into the superior epigastric and the musculophrenic arteries.

### Second Part of the Subclavian Artery

The second part of the subclavian artery lies behind the scalenus anterior muscle (Fig. 11.57).

**Branches** The **costocervical trunk** runs backward over the dome of the pleura and divides into the **superior intercostal artery,** which supplies the 1st and the 2nd intercostal spaces, and the **deep cervical artery,** which supplies the deep muscles of the neck.

### Third Part of the Subclavian Artery

The third part of the subclavian artery extends from the lateral border of the scalenus anterior muscle (Fig. 11.57) across the posterior triangle of the neck to the lateral border of the 1st rib, where it becomes the axillary artery. Here, in the root of the neck, it is closely related to the nerves of the brachial plexus.

**Branches** The third part of the subclavian artery usually has no branches. Occasionally, however, the superficial cervical arteries, the suprascapular arteries, or both arise from this part.

## CLINICAL NOTES

**Palpation and Compression of the Subclavian Artery in Patients with Upper Limb Hemorrhage**

In severe traumatic accidents to the upper limb involving laceration of the brachial or axillary arteries, it is important to remember that the hemorrhage can be stopped by exerting strong pressure downward and backward on the third part of the subclavian artery. The use of a blunt object to exert the pressure is of great help, and the artery is compressed against the upper surface of the 1st rib.