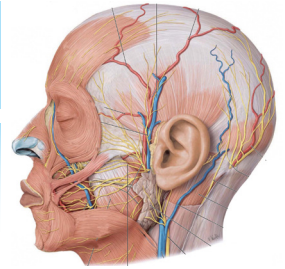


Scalp and Superficial Temporal Region



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Learning Objectives

At the end of the dissection of the scalp and superficial temporal region, you should be able to identify, understand, and correlate the following clinical aspects:

- Layers of the scalp: Skin, superficial fascia, galea aponeurotica, loose connective tissue layer, and pericranium.
- Nerves: Supratrochlear, supraorbital, auriculotemporal, lesser occipital, and great auricular.
- Vessels: Supratrochlear, supraorbital, superficial temporal, posterior auricular, and occipital.
- Muscle: Occipitofrontalis muscle and epicranial aponeurosis.
- Extension of the galea aponeurotica (epicranial aponeurosis) or superficial temporal fascia.
- Temporal fascia or deep temporal fascia.

Scalp

Introduction

The scalp is defined as the soft tissue covering the vault of the skull. Anteroposteriorly, it extends from the eyebrows to the external occipital protuberance and superior nuchal lines. On the lateral sides, it extends up to the right and left superior temporal lines.

Surface Landmarks

Before starting the dissection, you should quickly identify the following surface landmarks on the cadaver (refer to **Figs. 1.3** and **1.4**).

Palpate the *supraorbital margin* deep to the eyebrow and *glabella* between the two eyebrows in midline (just above the root of the nose). The *superciliary arch* can be palpated just above the supraorbital margin. Feel the *frontal eminence* on the right and left sides of the forehead and the *external occipital protuberance* on the posterior aspect of the head (in midline, at the junction of the head and neck). Try to palpate the superior nuchal lines on either side of the occipital protuberance. Palpate the *zygomatic arch* between the auricle and the cheekbone (zygomatic bone).

Dissection and Identification

A. Skin incision and reflection.

1. Shift the head end of the supine cadaver to the edge of the dissection table and place a wooden block under the cervicothoracic junction. This will give you a clear space to work on the occipital region as well.
2. Give a median incision "A" from the root of the nose to the external occipital protuberance. Give a coronal incision "B" starting at the middle of incision "A" up to the auricle on both sides. From the auricle, extend this incision behind up to the mastoid process and in front up to the root of the zygoma (**Fig. 2.1**).
3. Before reflecting the skin, you should know the location of blood vessels and nerves in the superficial fascia of the scalp so that you are careful to protect these structures while reflecting the skin.
4. Reflect the skin in four flaps, beginning at the midline (at the junction of the coronal and midline incisions). Proceed toward the periphery up to the zygomatic arch on either side, eyebrows anteriorly and occipital protuberance posteriorly. You may give additional coronal incisions to reflect the skin in smaller flaps.
5. Reflect the skin carefully as superficial fascia (second layer of the scalp) is very dense at the vertex (because dense strands of fibrous tissue traverse the superficial fascia connecting the undersurface of the skin to the epicranial aponeurosis). It will be really difficult to separate the first three layers and find the nerves and vessels in the second layer (superficial fascia). Therefore, the upper three layers of the scalp may often come together.

B. Exposure of muscles, blood vessels, and nerves beneath the skin of the forehead.

1. Now this is the time to expose the upper part of the orbicularis oculi muscle and frontal belly of the occipitofrontalis muscle beneath the skin of the forehead (as they lie in the superficial fascia).
2. Identify the nerves and vessels of the scalp as they are running in the second layer of the scalp. It will be really difficult to trace these nerves as they run in dense connective tissue.

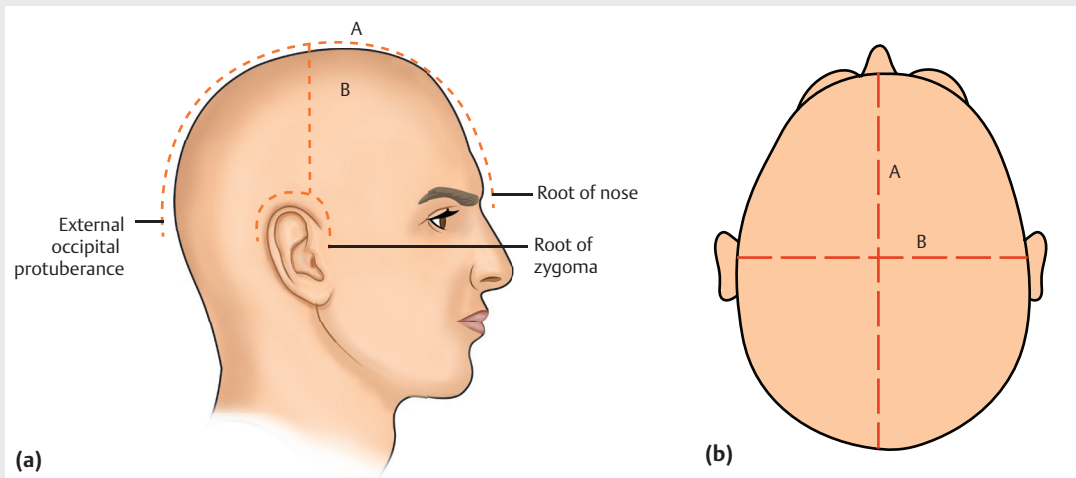


Fig. 2.1 (a,b) Skin incisions for scalp dissection.

3. The location of the nerves and vessels can be assessed as follows:
 - a. The supratrochlear nerve and vessels are located at a fingerbreadth away from the glabella.
 - b. Feel the supraorbital notch/foramen and then trace the supraorbital nerve and vessels from here, as they pass upward into the scalp.
 - c. Feel the zygomatic arch near the auricle and then trace the auriculotemporal nerve and superficial temporal artery from here, as they pass upward into the scalp.

C. Exposure of the occipital bellies of the occipitofrontalis muscle, nerves, and vessels behind the ear.

1. Turn the cadaver to the prone position (face facing downward) so that the posterior part of the scalp can be dissected easily.
2. Separate the skin from the superficial fascia toward the nuchal lines and external occipital protuberance.
3. Identify the nerves and vessels present in the superficial fascia behind the ear. Similarly, see the origin of the occipital bellies of the occipitofrontalis muscle from the highest nuchal lines. Observe the attachment of the epicranial aponeurosis to the external occipital protuberance. Similarly, trace the attachment of the frontal and occipital bellies with the epicranial aponeurosis.

Layers of the Scalp (Video 2.1)

The scalp consists of five layers (**Fig. 2.2**):

1. *Skin*: Note that the skin is thick and adherent to the third layer (epicranial aponeurosis). As the skin of the scalp is hairy, it contains lots of sebaceous glands.
2. *Superficial fascia*: This layer is dense and fibrous. The fibrous strands bind the skin to the epicranial aponeurosis. This layer contains the blood vessels and nerves of the scalp.
3. *Occipitofrontalis muscle and epicranial aponeurosis* (**Fig. 2.3**): The flat epicranial aponeurosis is the tendon uniting the frontal and occipital bellies of the occipitofrontalis muscle. The frontal belly is attached posteriorly to the epicranial aponeurosis. The aponeurosis is attached posteriorly to the external occipital protuberance and the medial part of the highest nuchal lines. The occipital bellies originate from the lateral part of the highest nuchal lines on either side and are inserted on the aponeurosis. On each of the lateral sides, the aponeurosis is attached partly to the temporal line. The aponeurosis can slide freely on the pericranium (fifth layer of the scalp). The frontal and occipital parts of the muscle can move the scalp forward and backward over the vault of the skull.
4. *Layer of loose areolar tissue*: This layer of loose connective tissue is placed between the third and fifth layers of the scalp and extends throughout the scalp. This layer gives a passage to the emissary veins.
5. *Pericranium*: This layer is formed by the periosteum of the cranial bones of the vault.



Video 2.1 Layers of the scalp.

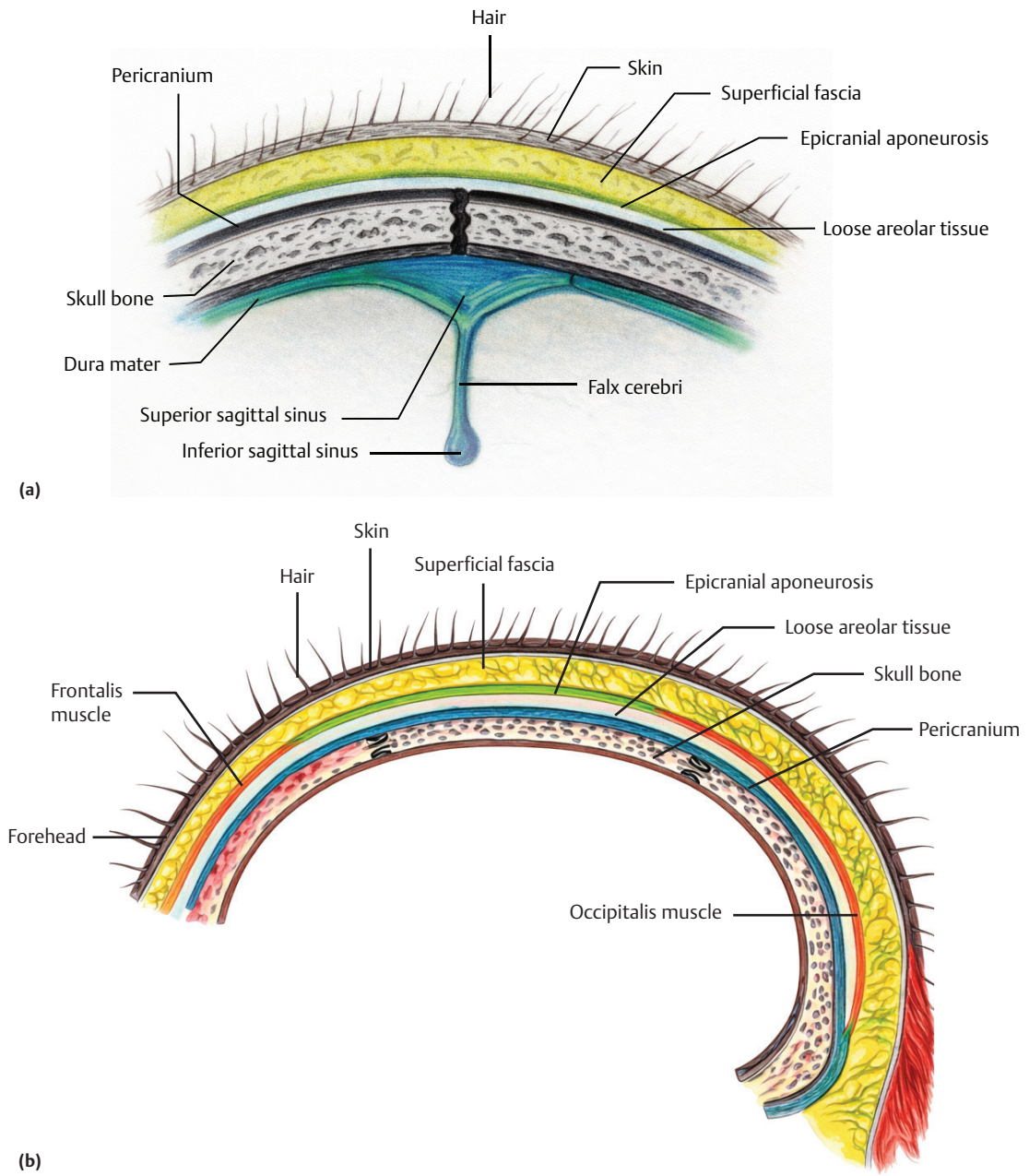


Fig. 2.2 Schematic drawing showing layers of the scalp as seen in the (a) coronal section and (b) parasagittal section passing through the scalp and skull (also refer to Fig. 12.5).

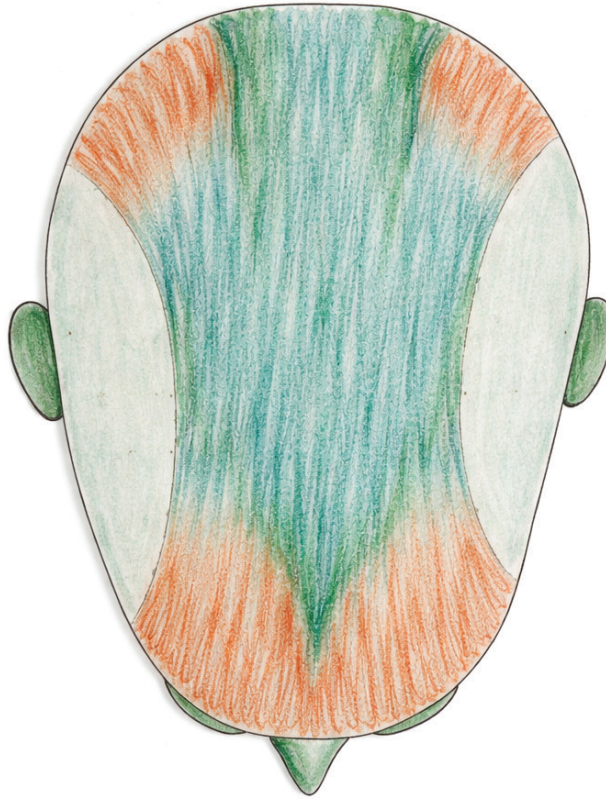


Fig. 2.3 Occipitofrontalis muscle.

Blood Vessels and Nerves of the Scalp

The scalp is richly supplied by blood vessels and sensory nerves. Blood vessels of the scalp are mentioned in **Table 2.1**. They are branches from the external and internal carotid arteries and anastomose extensively with each other in the scalp (**Fig. 2.4**).

The facial nerve (cranial nerve [CN] VII) supplies the motor fibers to the occipitofrontalis muscle. Its temporal branch is present in front of the auricle and innervates the frontal belly, whereas its posterior auricular branch is present behind the auricle and supplies the occipital belly (refer to **Fig. 2.4**).

The sensory nerves, which supply the skin of the scalp in front of the auricle, are branches of the trigeminal nerve. While the nerves that supply the skin of the scalp behind the ear are branches from the spinal nerves (C2 and C3) (**Table 2.2**; also refer to **Fig. 2.4**).

Table 2.1 Blood vessels of the scalp

Name	Source
1. Supratrochlear artery	Branch from the ophthalmic artery (branch of the internal carotid artery)
2. Supraorbital artery	Branch from the ophthalmic artery (branch of the internal carotid artery)
3. Superficial temporal artery	Branch from the external carotid artery
4. Posterior auricular artery	Branch from the external carotid artery
5. Occipital artery	Branch from the external carotid artery

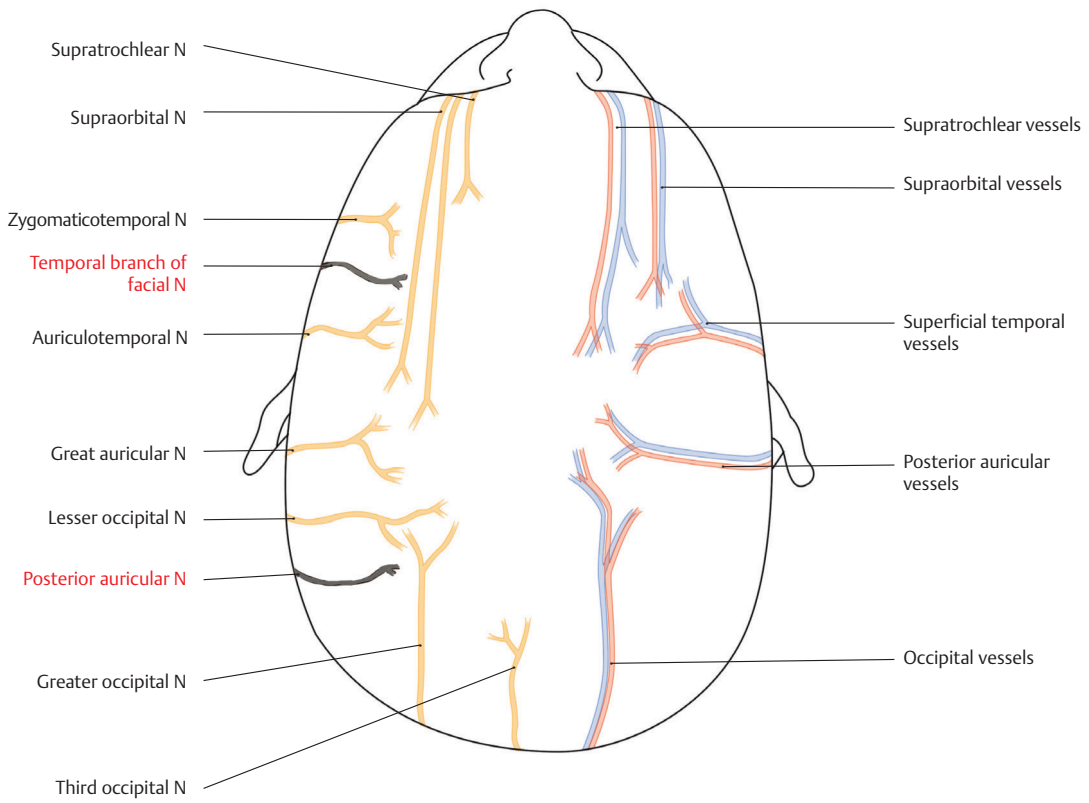


Fig. 2.4 Nerves and vessels of the scalp. (Motor nerves are drawn in *black* and labeled in *red*.)

Table 2.2 Sensory nerves of the scalp

Name	Source	Area supplied
<i>Sensory nerves present in front of the auricle</i>		
1. Supratrochlear	Branch from the ophthalmic division of the trigeminal nerve (CN V)	Skin of the forehead near the midline
2. Supraorbital	Branch from the ophthalmic division of the trigeminal nerve (CN V)	Skin of the forehead and the scalp up to the vertex
3. Zygomaticotemporal	Branch from the maxillary division of the trigeminal nerve (CN V)	Skin of the anterior part of the temporal region
4. Auriculotemporal	Branch from the mandibular division of the trigeminal nerve (CN V)	Upper part of the auricle, part of the external acoustic meatus, and side of the head
<i>Sensory nerves present behind the auricle</i>		
1. Great auricular nerve	Branch from the cervical plexus (ventral ramus of C2 and C3)	Its posterior branch supplies a small area of the scalp just behind the auricle adjacent to the mastoid process
2. Lesser occipital	Branch from the cervical plexus (ventral ramus of C2)	It supplies the posterior aspect of the scalp region posterior to the mastoid process

3. Greater occipital	It is the medial branch of the dorsal ramus of the C2 spinal nerve	It supplies the back of the scalp up to the vertex
4. Third occipital	It is the dorsal ramus of the C3 spinal nerve	It supplies the skin covering the external occipital protuberance and the neighboring area

Abbreviation: CN, cranial nerve.

Deeper Dissection

Once you have dissected and seen the structures related to the three layers of the scalp, it is time to study the fourth and fifth layers.

1. Make a small cruciate incision in the epicranial aponeurosis near the vertex. Introduce a metallic probe through this incision deep to the aponeurosis. Your probe is now in the fourth layer of the scalp (layer of the loose areolar tissue) and above the pericranium. The probe will be obstructed posteriorly near the nuchal lines as the aponeurosis is attached to the highest nuchal line. Similarly, the probe will be obstructed laterally as the aponeurosis is adherent to the temporal lines on the lateral side. There is no obstruction to the extent of the fourth layer anteriorly.
2. Make the median and coronal incisions in the occipitofrontalis and epicranial aponeurosis similar to skin incisions (refer to **Fig. 2.1**). Reflect the muscle and aponeurosis to expose the loose areolar tissue layer completely.
3. Note the pericranium (fifth layer) covering the various bones of the vault. Also, see various sutures on the vault.

Clinical Notes

The clinical anatomy of the scalp is described layer by layer (refer to Figs. 2.2 and 2.5):

1. **Skin:** Because of the presence of a lot of sebaceous glands, which are associated with hair follicles, *multiple sebaceous cysts* and *infected sebaceous glands* may be found in the skin of the scalp. Various types of *tumors* (benign and malignant) may also arise from the skin.
2. **Superficial fascia (dense connective tissue layer):** As this layer is made up of dense connective tissue, *there is limited space and, therefore, infection of this layer is limited to a small area*. Owing to the same reason, increased pressure on the nerve leads to *severe pain*.

Wounds of the scalp bleed profusely because of two reasons. First, it is richly supplied with blood vessels. Second, when a blood vessel is cut, the fibrous strands of the second layer hold the lumen of the vessel open, leading to excessive bleeding. Bleeding can be arrested by applying pressure on the vessels.

3. **Epicranial aponeurosis:** As the skin is firmly attached to the aponeurosis by fibrous strands of the second layer, the upper three layers of the scalp are fused and act as a single layer. A wound of the scalp extending through these three layers will gape when the aponeurosis is cut in the transverse direction. However, the wound will not gape when the aponeurosis is cut in the anteroposterior direction. This is because the pull of the occipitofrontalis muscle is in the anteroposterior direction (**Fig. 2.3**).

If a portion of the scalp is torn off due to an injury and if it is stitched back, it will heal well due to the profuse blood supply and extensive arterial anastomosis.

4. **Layer of the loose areolar tissue:** The presence of the loose connective tissue layer allows the first three layers of the scalp to slide freely on the pericranium. As the emissary veins pass through this layer, they may bleed, and the infection may pass on to the cranial cavity through these emissary veins.

The loose connective tissue layer is also known as the *dangerous area of the scalp* because bleeding and infection can spread widely (due to its extensiveness) within this layer. Anteriorly, the bleeding may reach the orbital margin, eyelid (leading to the formation of a *black eye* due to clotting of blood deep to the eyelid).

5. **Pericranium:** It is the periosteum lining the outer aspect of the cranial vault. The bleeding deep to the pericranium (*cephalohematoma*) does not extend beyond the margin of the bone as the pericranium at the margins of the bone is attached to the sutural ligaments. The shape of the bleeding (swelling) resembles the shape of the bone.

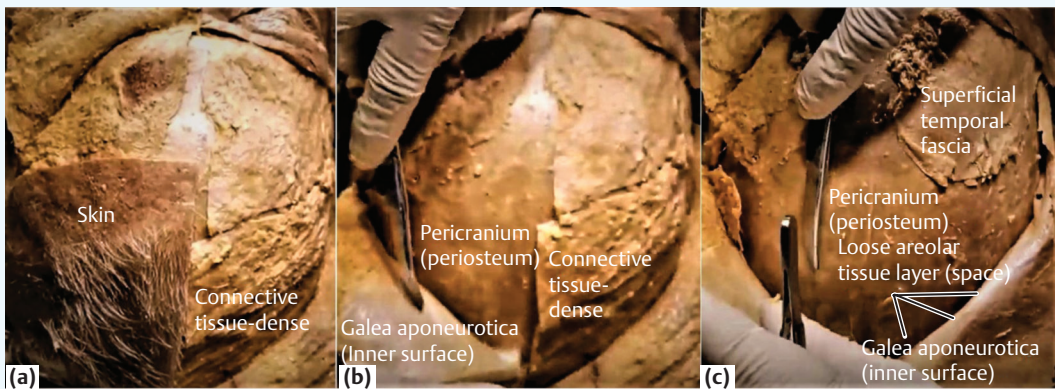


Fig 2.5 (a–c) Dissections showing different layers of the scalp.

Superficial Temporal Region (or Temple)

The temporal region extends between the temporal line (above) and the zygomatic arch (below) (refer to **Fig. 1.4**). It contains the temporalis muscle covered by the temporal fascia.

Dissection and Identification

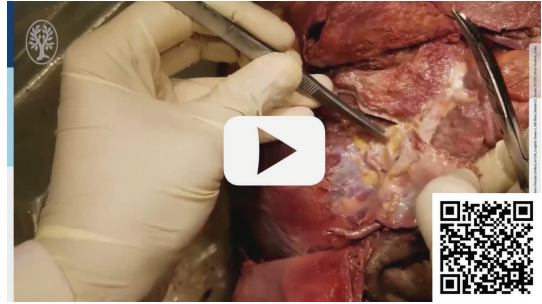
1. We have already reflected the skin from the temple region while dissecting the scalp.
2. In the superficial fascia, look for the nerves and vessels (superficial temporal artery and vein, auriculotemporal nerve, temporal branch of facial nerve, and zygomaticotemporal nerve) (refer to **Fig. 2.4**).
3. Clean the temporal fascia (deep temporal fascia) covering the temporalis muscle and note its attachments above the temporal line and below the zygomatic arch.

You should note that we shall dissect the temporal fossa (structures deep to the temporal fascia) with the dissection of the temporal and infratemporal region. (Refer to Chapter 9.)

Layers of the Superficial Temporal Region (Video 2.2)

The superficial temporal region presents six layers of soft tissues (**Fig. 2.6**):

1. **Skin:** The skin of the temple region is soft and thin as compared to the scalp.
2. **Superficial fascia:** Superficial fascia contains fat and loose connective tissues. The dense connective tissue of the scalp is absent in this region. This region contains the superficial temporal artery (terminal branch of the external carotid artery), the superficial temporal vein, and the auriculotemporal nerve (sensory branch of the mandibular nerve) (refer to **Fig. 2.4**).
3. **Extension of epicranial aponeurosis and auricular muscles:** A thin extension of the aponeurosis occurs from the superior temporal line toward the ear and zygomatic arch. This thin extension of fascia is sometimes called the “*superficial temporal fascia*.” This lies superficial to the deep temporal fascia. There are three extrinsic auricular muscles, that is, anterior, superior, and posterior auricularis.
4. **Temporal fascia (deep temporal fascia):** It is very tough and extends from the superior temporal line to the zygomatic arch covering the temporalis muscle located just deep to it. The temporalis muscle takes origin from its deep surface.
5. **Temporal muscle:** It is a fan-shaped muscle lying deep to the temporal fascia, occupying the temporal fossa. Its thick tendon passes downward behind the zygomatic arch to be inserted into the coronoid process of the mandible.
6. **Pericranium:** It is the periosteum lining the bones of the temporal fossa.



Video 2.2 Dissection of superficial temporal region.

Clinical Note

The superficial temporal artery is often used for palpation by an anesthetist when a surgery is performed below the neck region.

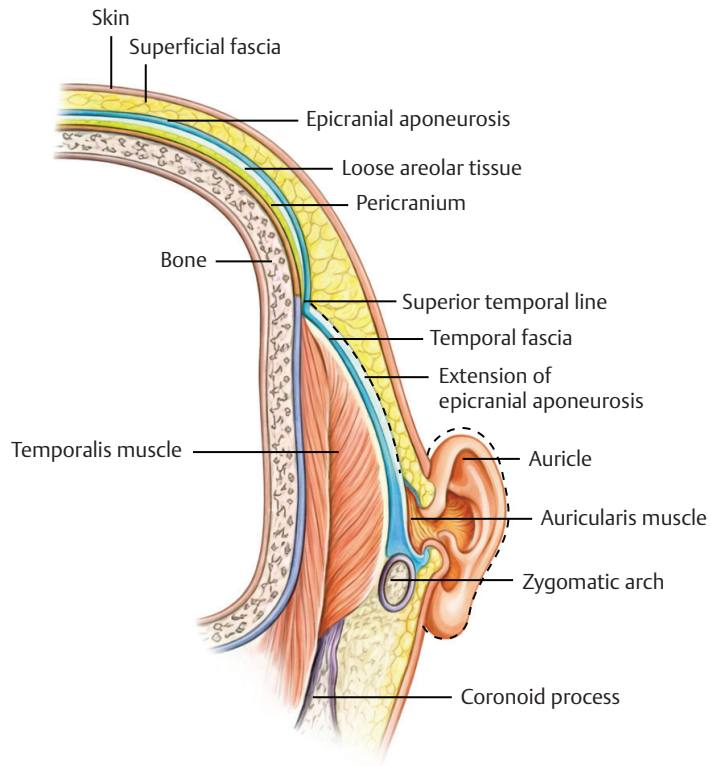


Fig 2.6 Illustration showing six layers of temporal region.