

# Chapter 1

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## The Scalp

### Chapter Outline

1. Layers and Muscles
2. Arteries
3. Veins
4. Nerves
5. Lymphatics

The head contains the brain, cavities for the special sensory organs, openings for the passage of air and food and teeth for mastication. The bony framework of the head is the skull. The scalp is the soft tissue covering the calvaria.

The scalp covers the cranium. It extends from the supraorbital margins in front to the superior nuchal lines behind and from one temporal line to the other laterally. It may be regarded as a prolongation of the facial skin and muscles over the vertex of the skull.

## 1. Layers and Muscles

The scalp comprises five layers which may be recalled by the acronym S (skin), C (close connective tissue), A (aponeurosis of the epicranium muscle), L (loose connective tissue) and P (pericranium):

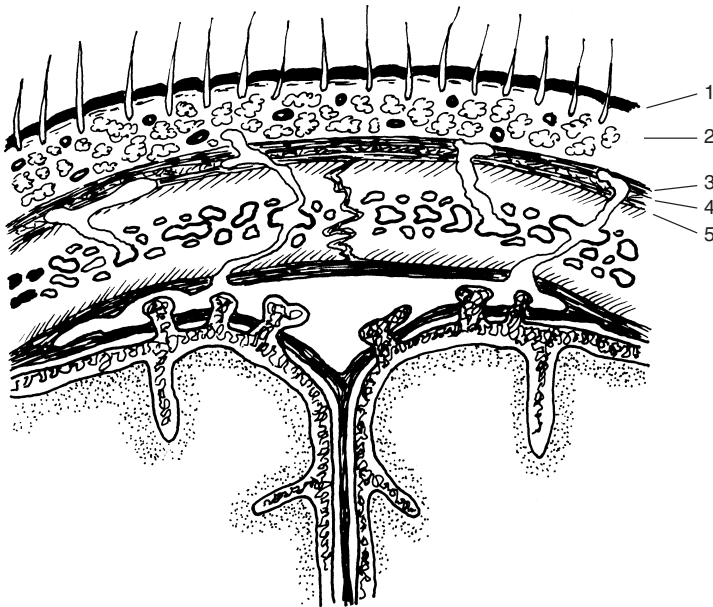
Skin, which is very thin and contains numerous long hairs (except over the forehead) sweat glands and sebaceous glands (it is the most common site for the occurrence of sebaceous cysts). It is firmly attached to the subcutaneous layer.

The subcutaneous layer is a dense vascularized and innervated connective tissue which firmly binds the skin to the

underlying aponeurotic layer. It contains fat enclosed in lobules. The amount of these lobules decrease with age.

Wounds involving this layer bleed profusely because the adventitia of blood vessels is firmly anchored to the dense connective tissue of this layer and are prevented from retracting.

**Epicranial aponeurosis** (galea aponeurotica) is a strong sheet of fibrous tissue extending between the frontal and occipital bellies of the occipitofrontalis (epicranium) muscle. It is attached to the external occipital protuberance and highest nuchal line behind. It extends down as a thin membrane over the temporal fascia to the zygomatic arch.



**FIG. 1-1** Layers of scalp. (1) Skin; (2) Subcutaneous tissue; (3) Galea aponeurotica; (4) Loose subaponeurotic tissue; (5) Pericranium.

Wounds of the scalp may not gape unless the epicranium or its aponeurosis is divided transversely.

## MUSCLES OF THE SCALP AND EXTERNAL EAR

These muscles belong to the same group as the muscles of facial expression and are similarly supplied by the facial nerve (VII).

Epicranium muscle consists of two bellies of the occipitofrontalis muscle that are connected by the intervening epicranial aponeurosis.

### Frontal Bellies (Frontalis)

Frontal bellies are long, wide and united. They have no bony attachments.

- **Origin:** Anterior part of epicranial aponeurosis.
- **Insertion:** Skin and dense connective tissue near the eyebrows and root of the nose.
- **Action:** Wrinkles the forehead transversely and pulls the scalp forward. Their antagonists are the orbital part of orbicularis oculi.
- **Nerve supply:** Temporal branch of the facial nerve (VII).

### Occipital Bellies (Occipitalis)

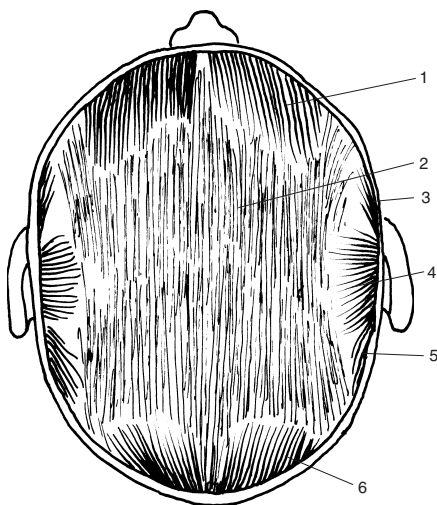
Occipital bellies are small and separate. They arise from bone.

- **Origin:** Lateral two-thirds of the superior nuchal line.
- **Insertion:** Posterior part of epicranial aponeurosis.
- **Action:** Draws the scalp backwards and fixes the scalp allowing

frontalis to pull on the skin of the forehead.

- **Nerve supply:** Posterior auricular branch of the facial nerve (VII).

Auricularis muscles are three small muscles inserted into the deep (cranial) aspect of the auricle (pinna). Auricularis anterior and superior are thin and fan shaped. They arise from the temporal fascia. Their nerve supply is the temporal branch of the facial nerve (VII). Auricularis posterior is a narrow muscle that arises from the mastoid process. It is supplied by the posterior auricular branch of the facial nerve (VII).



**FIG. 1-2** Musculoaponeurotic layer of scalp. (1) Frontal belly of occipitofrontalis; (2) Galea aponeurotica; (3) Auricularis anterior; (4) Auricularis superior; (5) Auricularis posterior; (6) Occipital belly of occipitofrontalis.

Loose subaponeurotic layer consists of loose connective tissue that allows movement of the first three layers and forms a subaponeurotic space. It contains emissary veins that connect the venous sinuses of the skull with the veins of the subcutaneous layer.

The subaponeurotic layer is sometimes called the “**danger space of the scalp**” because blood and pus can accumulate and infections spread easily in it limited only by the attachments of the epicranium and aponeurosis. Spread occurs into the periorbital connective tissue or via emissary veins to the intracranial region and cranial venous sinuses. This layer is the plane of separation in an injury that tears the scalp.

Pericranium is the external periosteum of the skull. It is loosely attached to the surface of the squamous skull bones and has poor osteogenic properties. At the suture lines, it dips between the skull bones as the suture membrane becomes continuous with the internal periosteum of the skull.

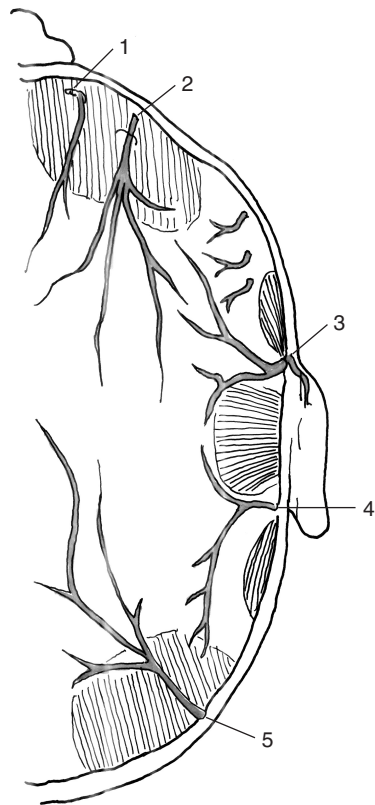
A skull fracture may cause bleeding in the subperiosteal plane limited to the individual skull bone by its attachments of the pericranium at the sutures.

## 2. Arteries of the Scalp

The scalp is supplied by five arteries, three anterior and two posterior to the coronal plane of the ear on each side. The anterior three are branches of the ophthalmic branch of the internal carotid

artery; and the posterior two are branches of the external carotid artery. They anastomose freely with one another artery with the arteries of the opposite side, they contribute to the rapid healing of scalp wounds.

**Supratrochlear artery** is a terminal branch of the ophthalmic artery (from the internal carotid artery). It leaves the upper medial angle of the orbital margin piercing the superior palpebral fascia to



**FIG. 1-3** Arteries of scalp. (1) Supratrochlear a.; (2) Supraorbital a.; (3) Superficial temporal a.; (4) Posterior auricular a.; (5) Occipital a.

supply the anterior and medial scalp of the forehead. It anastomoses with its opposite artery and the supraorbital artery.

**Supraorbital artery** is also a branch of the ophthalmic artery (from the internal carotid). It leaves the supraorbital foramen or notch of the orbital margin ascending over the frontal bone to supply the forehead and vault of the skull. It anastomoses with the angular branch of the facial artery and frontal branch of the superficial temporal artery.

**Superficial temporal artery** is a terminal branch of the external carotid artery. It divides in front of the auricle and supplies the parotid gland, adjacent muscles and glands of the face, anterior part of the external ear and scalp of the frontal and parietal regions. It anastomoses with the artery of the opposite side, frontal and supraorbital arteries.

**Posterior auricular artery** is a branch of the external carotid artery. It passes under the parotid gland, along the upper border of sternocleidomastoid then divides near the mastoid process and supplies the scalp above and behind the back of the ear. Its important stylomastoid branch supplies the facial nerve, middle ear and mastoid antrum and air cells. It anastomoses with the artery of the opposite side and with the occipital artery.

**Occipital artery** is a branch of the external carotid artery. It passes along the lower border of sternocleidomastoid, then it passes into the occipital groove deep to the mastoid process of

the temporal bone and reaches the scalp of the occiput. It supplies the surrounding muscles, dura of the posterior cranial fossa and skin over the occiput and anastomoses with the opposite occipital artery, posterior auricular and superficial temporal arteries.

### 3. Veins of the Scalp

Veins of the scalp parallel the arteries. They anastomose with each other, form a network within the subcutaneous layer, and receive emissary veins connecting with intracranial venous sinuses.

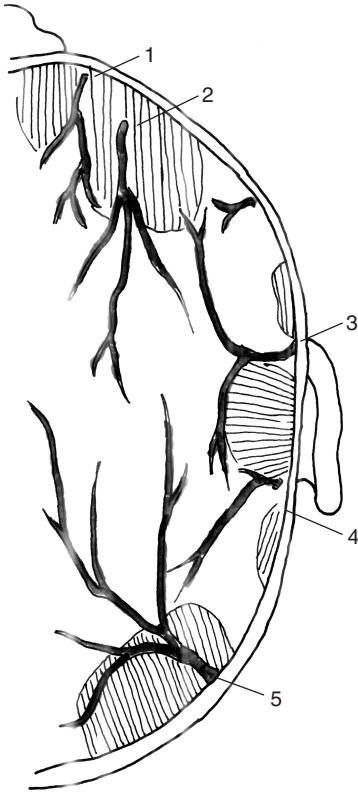
**Supratrochlear and supraorbital veins** drain the forehead, communicate with the superior ophthalmic vein, and unite at the medial angle of the eye to form the angular vein.

The angular vein communicates with the superior ophthalmic vein and then the cavernous sinus.

**Superficial temporal veins** descends from the temple to the upper part of the parotid gland, where it unites with the maxillary vein to form the retromandibular vein.

**Posterior auricular vein** forms from a plexus on the side of the head and back of the ear and descends behind the auricle. Below the parotid gland, it joins the posterior division of the retromandibular vein to form the external jugular vein.

**Occipital vein** drains the posterior parietal and occipital regions of the scalp. It pierces the trapezius, and



**FIG. 1-4** Veins of scalp. (1) Supratrochlear v; (2) Supraorbital v; (3) Superficial temporal v; (4) Posterior auricular v; (5) Occipital v.

terminates in the suboccipital plexus communicating with the vertebral vein.

#### 4. Nerves of the Scalp

Sensory nerves of the scalp are sequential branches of all three divisions of the trigeminal nerve and have a distribution similar to that of the blood vessels that accompany them. In addition, the area

behind the ears is supplied by the ventral rami of cervical spinal nerves arising in the neck from the cervical plexus (C2 and 3).

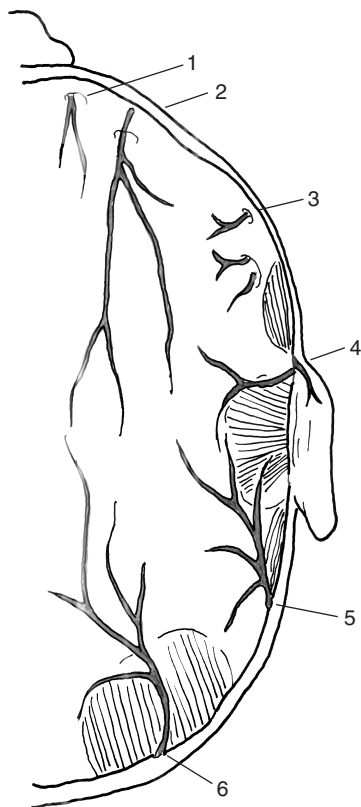
**Supratrochlear nerve**, a branch of the frontal nerve (of V1), leaves the orbit at the medial end of the supraorbital margin between the trochlea of the superior oblique muscle and supraorbital foramen or notch and pierces the frontal belly of occipitofrontalis to supply the medial part of the upper eyelid and forehead.

**Supraorbital nerve** is the continuation of the frontal nerve (of V1). It leaves the orbit through the supraorbital foramen or notch, pierces the frontal belly of the occipitofrontalis, then it supplies the forehead scalp to the vertex, upper eyelid and frontal sinus.

**Zygomaticotemporal nerve** is a branch of the zygomatic nerve (of V2). It leaves the orbit through the zygomatico-temporal foramen and supplies the anterior part of the temple.

**Auriculotemporal nerve** is a branch of the mandibular division of the trigeminal. It (V3) leaves the infratemporal fossa by winding behind the capsule of the temporo-mandibular joint. It then divides on the surface at the upper end of parotid gland and supplies the side of the scalp, auricle, and acoustic meatus (outer surface of the tympanic membrane).

**Lesser occipital nerve** (C2 ventral ramus from the cervical plexus) ascends along the posterior border of



**FIG. 1-5** Nerves of scalp. (1) Supratrochlear n; (2) Supraorbital n; (3) Zygomaticotemporal n; (4) Auriculotemporal n; (5) Lesser occipital n; (6) Greater occipital n.

sternocleidomastoid muscle between the ear and occipital artery. It supplies the skin of the head and cranial surface of the auricle.

**Greater occipital nerve** (C2 medial branch of dorsal ramus) also winds around the posterior border of sternocleidomastoid and ascends with the occipital artery to pierce semispinalis capitis and trapezius. It

supplies the posterior part of scalp, skin over the parotid and both surfaces of the auricle.

**Third occipital nerve** (C3 medial branch of dorsal ramus) ascends to pierce the trapezius and supply the skin of the back of the head.

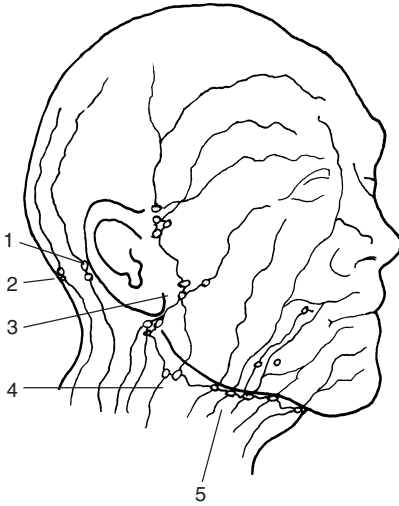
## 5. Lymphatic Drainage of the Scalp

Lymphatic vessels of the head and neck drain into the venous system at the junction of the internal jugular vein and subclavian vein directly from the tissues or indirectly after traversing outlying lymph nodes.

Lymph vessels of the scalp drain into superficial lymph nodes (superficial to the investing layer of deep cervical fascia) consisting of a few small nodes along the external jugular vein in line with the superficial parotid nodes. These drain into the deep cervical nodes (lie deep to the investing layer of deep cervical fascia and sternocleidomastoid muscle) and have been named according to their location.

In relation to lymphatic drainage of the scalp, some of the deep nodes are located in a collar at the junction of the head and neck on the stem of named arteries (“collar chain” nodes). These are:

**Occipital nodes** are one to three nodes overlying the superior nuchal line between the attachments of



**FIG. 1-6** Lymph nodes of head. (1) Retroauricular; (2) Occipital; (3) Parotid; (4) Superficial cervical; (5) Submandibular.

sternocleidomastoid and trapezius by the occipital artery. They receive vessels from the occipital scalp and upper neck and drain into superior deep cervical nodes.

**Mastoid nodes** are located with the posterior auricular artery behind the ear on the mastoid process. They drain the posterior parietal region and ear and their efferents drain into superior deep cervical nodes.

**Parotid nodes** are one or two nodes located in front of the tragus of the ear. They drain the anterior parietal and frontal regions of the scalp, eyelids, auricle and cheek; and drain into parotid and superior deep cervical nodes.