

## ■ SUPERFICIAL TEMPORAL ARTERY GALEA PEDICLED FLAP

This flap is a highly versatile flap that can be transferred, based on the superficial temporal artery or one of its branches. The superficial temporal artery can be palpated, and assistance from acoustic devices (Doppler) is rarely needed. The key point for superficial temporal artery flaps is the galea aponeurotica.

The superficial temporal artery is the base for a great variety of flaps; either pedicled or free<sup>(16)</sup>, to provide covering for reconstructed tendons<sup>(32)</sup>, bony structures<sup>(20)</sup>, or cartilages<sup>(6)</sup>, as filler for wrist ankylosis treatment<sup>(3)</sup>, to provide a gliding surface for tendons<sup>(4)</sup>, to transfer hair bearing skin<sup>(11)</sup>, or transfer split thickness<sup>(18)</sup> or full thickness parietal bone<sup>(20)</sup>. The auricular branch acts as a vascular bridge between the superficial temporal artery system and the posterior auricular artery, to act as a pedicle for the Washio flap<sup>(33)</sup>.

Though not mandatory, surgery will be facilitated if the scalp is shaved beforehand, when treating fistula or exposed bone fragments.

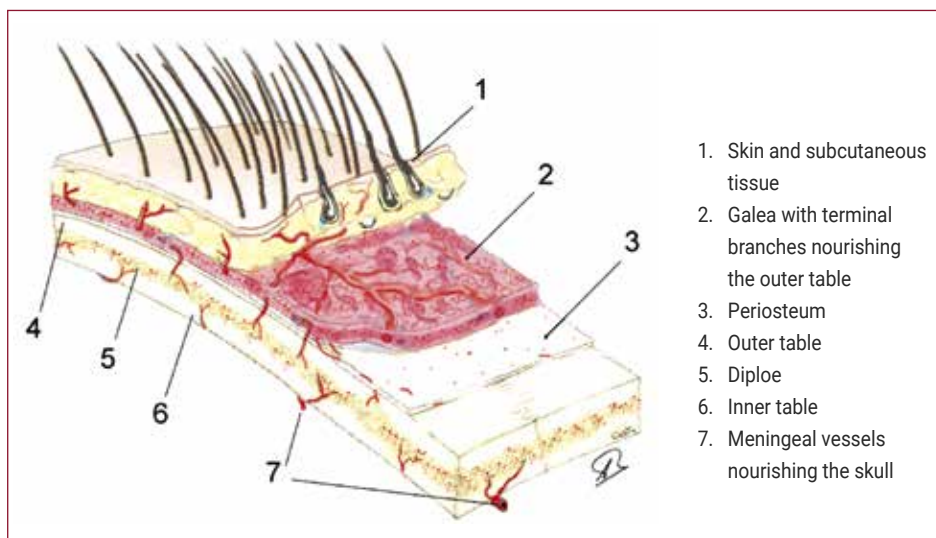
Raising any type of galea flaps, even when hair follicles have not been injured will cause edema and swelling of the subcutaneous tissue where the hair follicles are located. It will provoke temporary hair loss and alopecia. However, hair is restored after 4-6 weeks, so patients should be advised of this.

### Indications

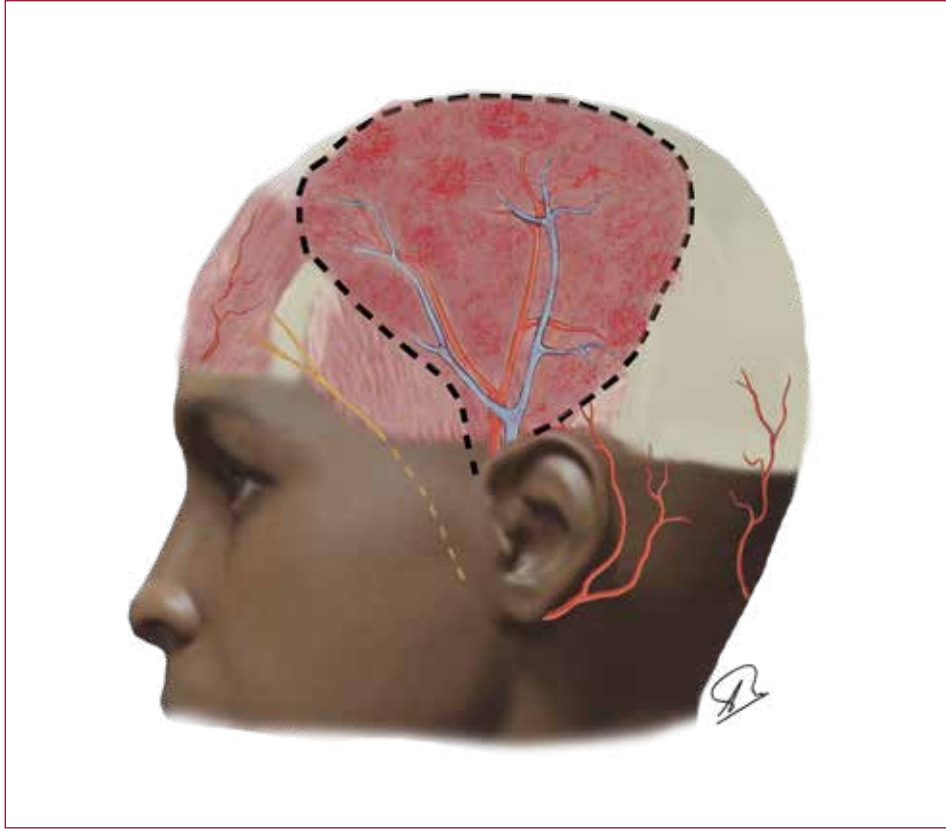
As a cutaneous flap, this flap has been used to bring a limited hair bearing skin island to the face (complete upper lip reconstruction in male patients). Though in these cases, the flap should be delayed to ensure safe vascularization. Small cutaneous hair bearing flaps have been used in the past to reconstruct eyebrows lost by burns. The main usefulness of this flap is to act as a barrier or protective layer for covering noble structures in the face or in the skull, acting as a layer for grafts or as a vascularized filler in the orbit or through the temporalis fossa in the palate in cases where huge fistulas cannot be covered by conventional flaps.

### Anatomy

The Galea is a thin a pliable layer of tissue under the scalp, the thinnest structure that can be transferred with its own vascular supply in the body. It is located between the skin and subcutaneous tissue, and the temporalis fascia (at the temporal region) and pericranium above the temporalis line (Fig. 4.5). Anteriorly it limits with the Frontalis muscle, posteriorly with the occipital muscle, inferiorly with the SMASS (superficial musculoaponeurotic system) and superiorly with the



**Figure 4.5.** Surgical anatomy and relationships of the Galea.



**Figure 4.6.** Broad galea flap including both branches, anterior (frontal) and posterior (parietal).

medial pericranium<sup>(31)</sup>. The Galea can be differentiated into three zones: the lowest or Temporoparietal fascia (which is richly vascularized), the Galea aponeurotica above the temporal line (which is well vascularized) and the pericranium (which is poorly vascularized by terminal branches). In addition, the scalp is inelastic, the galea aponeurotica is poorly elastic and the pericranium is nondistensible.

### Vascularization

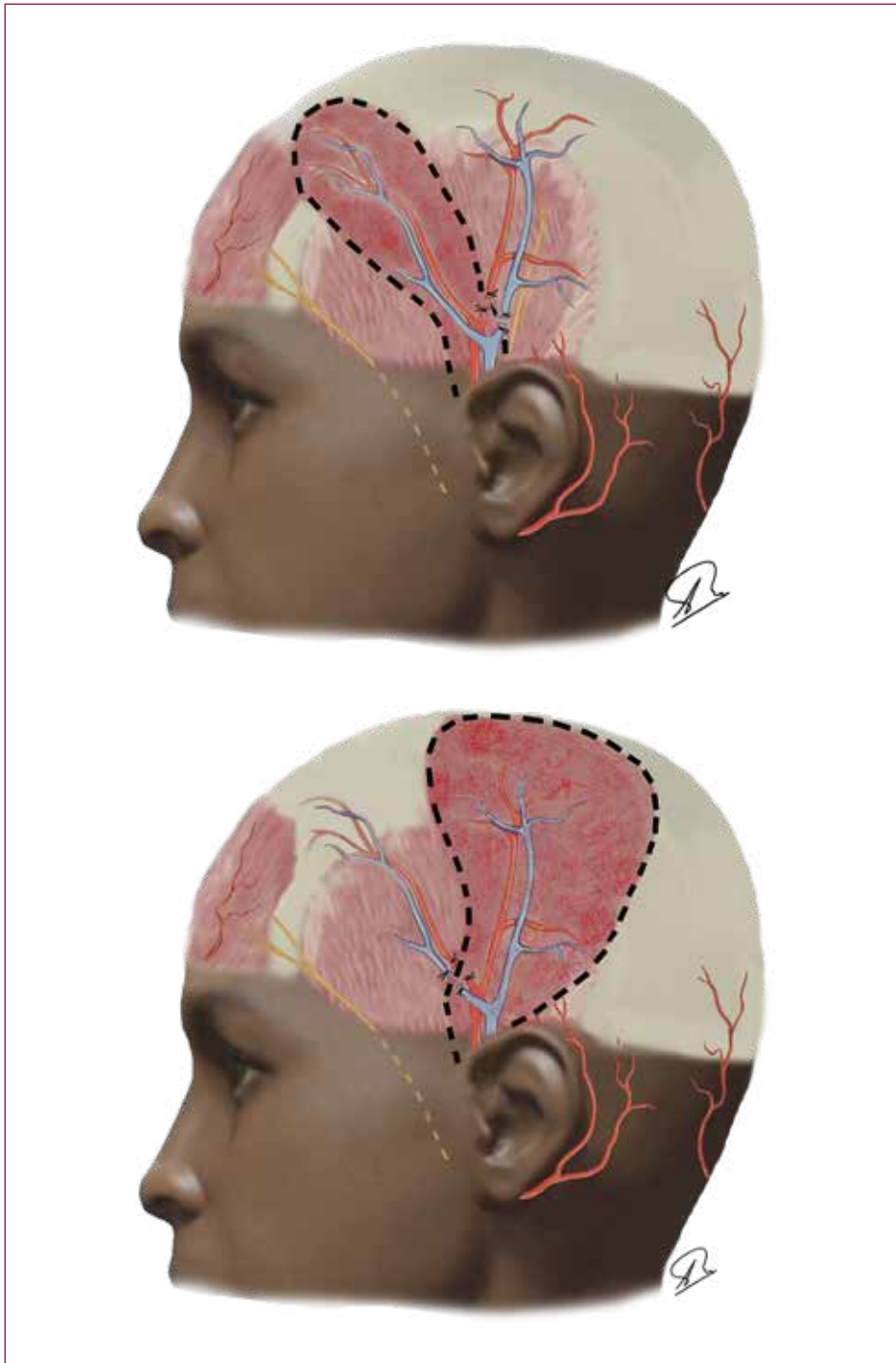
The Galea is vascularized by the temporal artery; a distal branch of the external carotid artery (Fig. 4.4-7). It usually extends from the frontal bone anteriorly to the occipital fascia, posteriorly on each side. Once inside the galea, the superficial temporal artery gives two main branches, the anterior (or frontal branch) and the posterior (or parietal branch) and a minor one, the auricular branch. All anastomose to create a rich

network of vessels. Terminal cutaneous branches of these vessels vascularize the scalp as well as parietal bones.

### Markings

The origin of the STA can be easily determined without Doppler or the assistance of acoustic devices. As the origin of the artery and its branches are always constant, the flap does not need a very precise outlining, especially if the flap is broad and includes both branches.

The flap does not need to be outlined over a shaved scalp. In fact the scalp is rarely shaved, but it is the incision that needs to be strategically placed, to facilitate undermining of the galea from the skin from a comfortable position, but especially to avoid, as far as possible, leaving the incision over an area where a craniotomy has been made.



**Figure 4.7.** Each one of the main branches from the STA can sustain separate flaps; anterior and medial galea flaps.

### Elevation

Flap elevation usually requires a bi-coronal approach, although previous incisions or debridement margins can be used if they provide a good exposure. The coro-

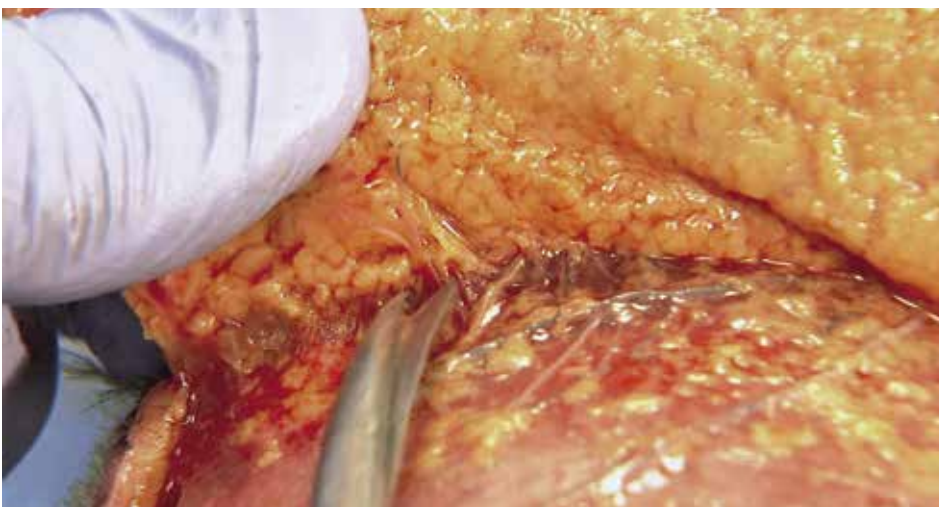
nal incision can be done over the outlined galeal flap, although if possible, it is better to place it on the anterior or posterior border of the flap. When the incision is planned

outside the flap boundaries, the scalp is not incised fully deep to the pericranium, it is always better to respect a strip of galea that will later facilitate two-layer closure at the end. Elevation starts with incising the galea on one of the flap's margins, firstly elevating the cutaneous flap from the galea. By doing this first, the galea will remain attached to the periosteum and dissection from the subcutaneous tissue will be facilitated. The scalp is pulled tight and folded, and the galea individualized by using the knife (never the cautery) taking care not to go too deep and compromise the galea vascularization or too

superficially and destroy the hair follicles. Although the galea is easily identified, it is not so easily individualized from the scalp since there is not a surgical plane for dissection, and the space between the scalp and galea is almost inexistent. An excellent reference for being on the right plane of elevation is the bottom of the hair follicles (Figs. 4.5 and 4.18). They should be seen on the scalp flap but never incised. Galea individualization in bald patients is more difficult as the scalp is thinner in these patients. However, there is no risk for post-operative alopecia.

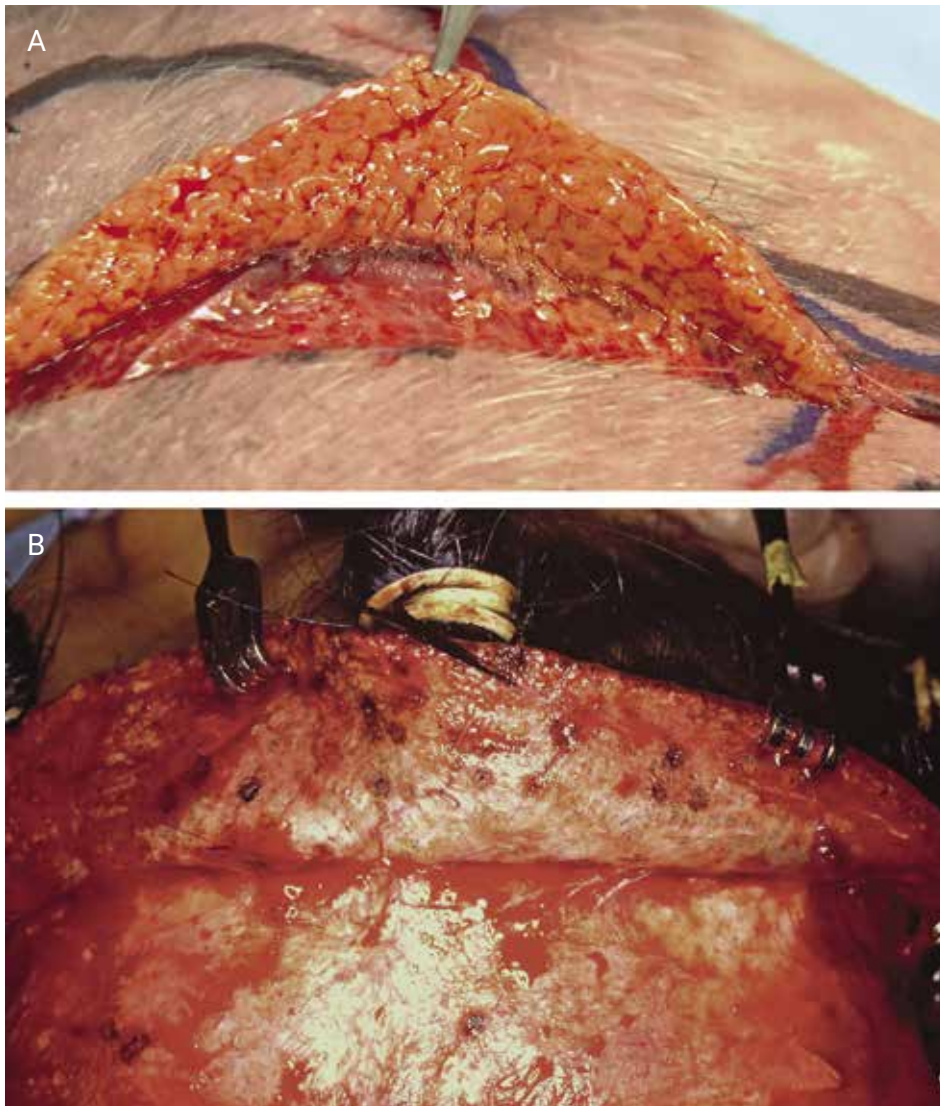


**Figure 4.8.** Outlining of a galea flap over the scalp and frontal and parietal branches from the Superficial Temporal artery.



**Figure 4.9.** The scalp is firmly attached to the galea by fibrous connections - nerves and terminal vessels emerging from the superficial temporal artery (STA) branches. Elevation is tedious and time consuming and can be performed with either knife or scissors. Fibrous attachments have to be divided without injuring the vessels below (galea) and hair bulbs above (subcutaneous tissue of the scalp).

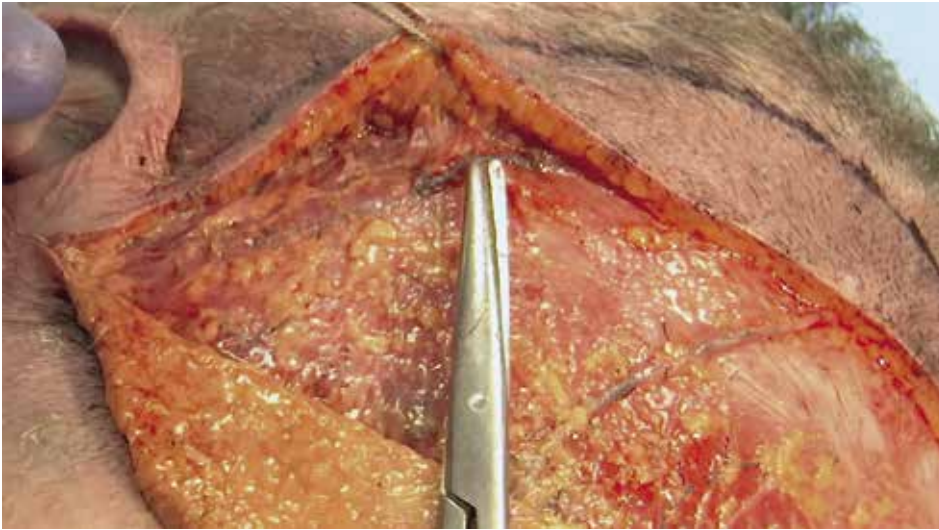




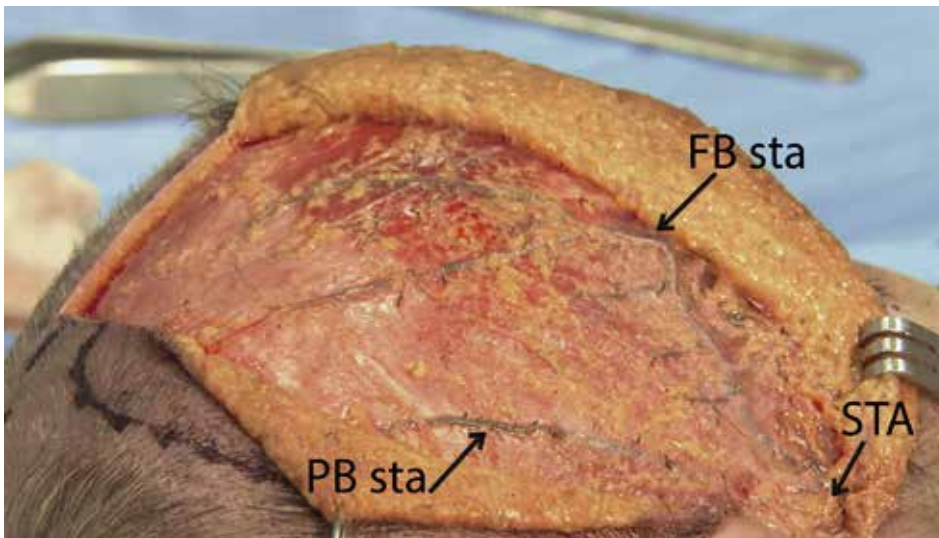
**Figure 4.10.** A) Frontal scalp flap elevated. The plane of dissection between the cutaneous flap and galea (containing the terminal branches of the STA) can be seen in a fresh cadaver dissection. B) Surgical plane to individualize the galea from the scalp. If great attention is paid, small black tips can be seen on the scalp surface which are in fact the roots of the individual hair bulbs. This is the proper plane—seeing the bulbs but never incising them.



**Figure 4.11.** Proximal dissection over the common trunk of the STA should be carried out carefully to avoid injury and to search for each of the main branches.



**Figure 4.12.** Each branch is dissected free from its cutaneous attachments and traced up to midline.

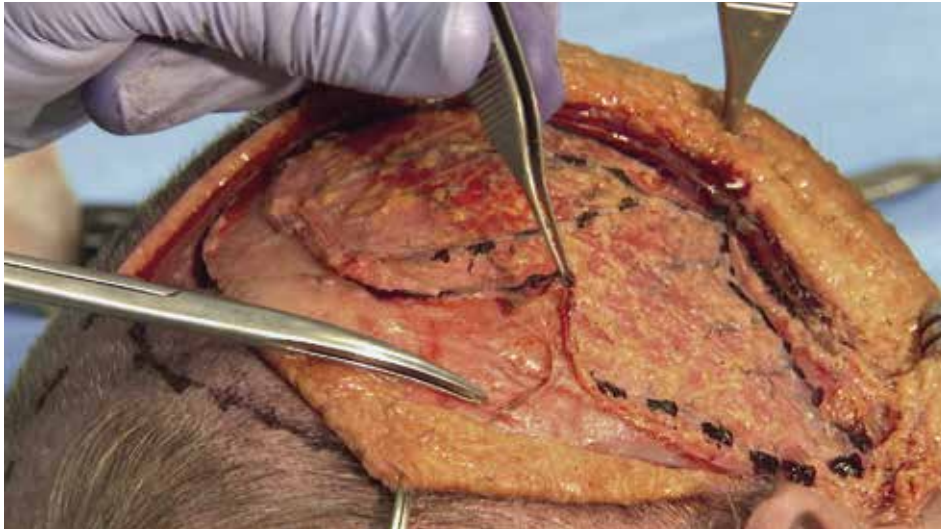


**Figure 4.13.** Anterior and posterior cutaneous scalp flaps have been elevated and folded anteriorly and posteriorly to expose both the frontal and parietal branches. Contrary to classical descriptions, in this specimen the frontal branch is larger than the parietal branch.

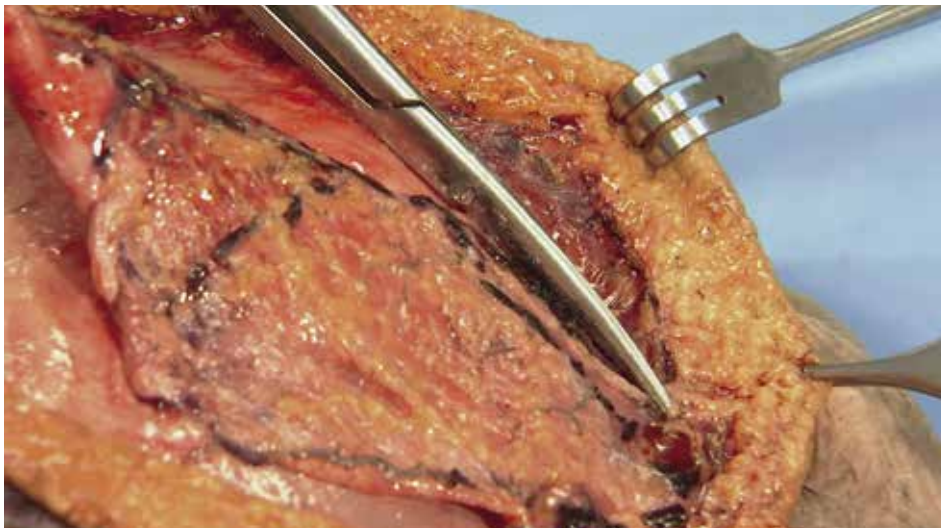


**Figure 4.14.** Galea flap outlined including both branches of the STA. It is incised deep to the periosteum and the superficial temporal fascia without including them in the flap.

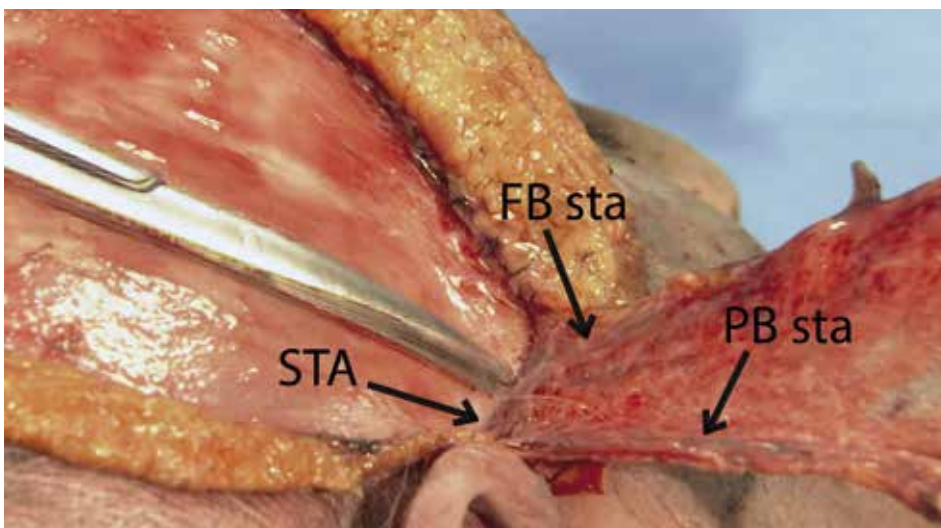




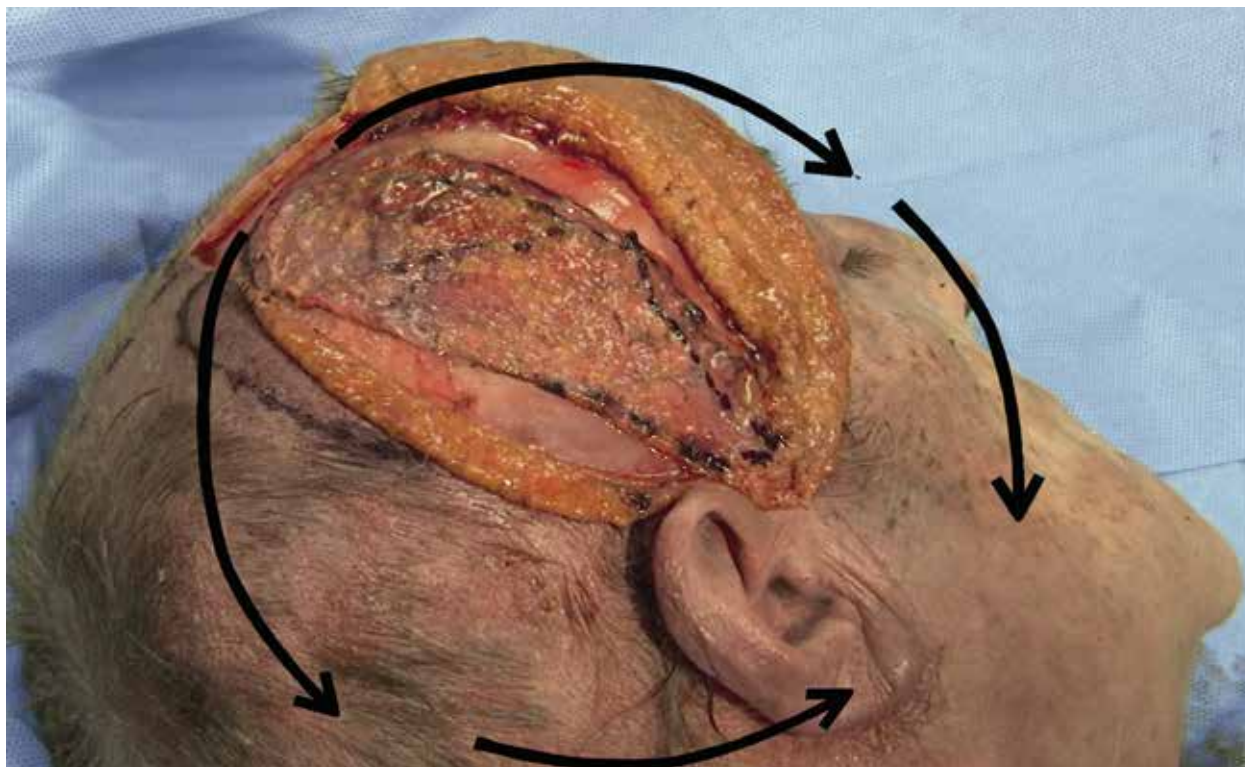
**Figure 4.15.** Once the flap has been completely incised it is then detached from the periosteum distally and the temporalis fascia proximally. Elevation is easy and quick compared with dissection from the scalp. However, temporal vessels included into the galea should not be injured. Small perforator branches vascularizing the cranial vault are divided, while major branches are divided and ligated.



**Figure 4.16.** Once the flap has been completely incised it is then detached from the periosteum distally and the temporalis fascia proximally. Elevation is easy and quick compared with dissection from the scalp. However, temporal vessels included into the galea should not be injured. Small perforator branches vascularizing the cranial vault are divided, while major branches are divided and ligated.



**Figure 4.17.** Galea flap already elevated showing from its deep surface the STA and its two main branches, the Frontal branch (FB sta) and Parietal branch (PB sta). In case a longer pedicle is needed, STA and galea can be traced over the zygomatic arch.



**Figure 4.18.** Arch of rotation of the superficial temporal artery Galea flap. It is a highly, thin and pliable tissue that can be rotated to cover defects or fill gaps in the two upper thirds of the face, the entire ear and posterior aspects of the parietal bone.