

Novel Hybrid Technique for Preservation of Frontal Branch of Facial Nerve: Subgaleal Preinterfascial Dissection

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■ **OBJECTIVE:** The pterional approach is the workhorse of skull-base neurosurgery, which allows virtual access to any intracranial lesion around the circle of Willis. Preserving the frontotemporal branch of the facial nerve and conserving the temporal muscle's symmetry are fundamental objectives besides the access that can be obtained through this versatile neurosurgical technique. This manuscript proposes a subgaleal preinterfascial dissection, a novel hybrid technique that provides advantages of previously described temporal muscle dissection techniques while preserving the integrity of facial nerve branches and the unobstructed broad pterional region. We describe the subgaleal preinterfascial dissection as a safe and simple to technique to achieve preservation of the facial nerve frontal branches during anterolateral approaches.

■ **METHODS:** Two cadaveric heads were skillfully dissected and studied to perform a proper subgaleal preinterfascial dissection on both sides of each cadaver. Afterward, the same technique was employed in 108 patients during a pterional approach for different neurosurgical diseases, with a postoperative follow-up of 6 months.

■ **RESULTS:** None of the 108 patients presented postoperative frontotemporal branch palsy during postoperative follow-up. Likewise, no complications related to the proposed technique were present.

■ **CONCLUSIONS:** The subgaleal preinterfascial dissection is a reliable, safe technique that may be employed during a pterional approach with an unobstructed surgical view and excellent cosmetic and functional results, preserving the frontotemporal branch of the facial nerve.

INTRODUCTION

The pterional approach (PA), popularized by Yaşargil almost 40 years ago, stands as one of the most versatile neurosurgical techniques because it allows access to virtually any intracranial lesion located within reach of the circle of Willis.¹ When performing any anterolateral approach (e.g., pterional or orbitozygomatic), 2 fundamental principles must be followed: preservation of the frontotemporal branch (FTB) of the facial nerve² and prevention of temporal muscle atrophy.³ Injury to the FTB results in cosmetic defects due to facial asymmetry and eyebrow raise impairment due to orbicularis oculi, supercilli corrugator, and frontalis muscle palsy. This damage might occur after direct trauma or during muscle retraction.⁴

Several techniques have been described to preserve the FTB of the facial nerve and the temporal muscle, while soft tissue dissection is still enough to allow for proper visualization of the pterional region. However, most can be included within these 3 basic categories: 1) myocutaneous dissection,⁵ which provides

Key words

- Dissection
- Facial nerve
- Frontal
- Interfascial
- Preservation
- Subgaleal

Abbreviations and Acronyms

- FTB:** Frontotemporal branch
PA: Pterional approach
PIP: Preinterfascial point
SPD: Subgaleal preinterfascial dissection
STA: Superficial temporal artery
STF: Superior temporal fascia
STL: Superior temporal line

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the most protection of the FTB, although less pterional exposure is achieved due to a minor capability of muscle mobilization; 2) subfascial dissection⁶; and 3) interfascial dissection,⁷ which provides the best pterional exposure but poses the most significant risk for FTB injury.

This manuscript aims to propose a subgaleal preinterfascial dissection (SPD), which we describe as a hybrid technique that provides the advantages of both the myocutaneous and

interfascial dissections in that it safely preserves the FTB of the facial nerve and allows for full-scale mobilization of the temporal muscle in a lateral and ventral direction, leaving the pterional region unobstructed.

METHODS

Two adult cadaveric heads (4 sides), fixed with formaldehyde and injected with colored silicone, were studied. A PA was

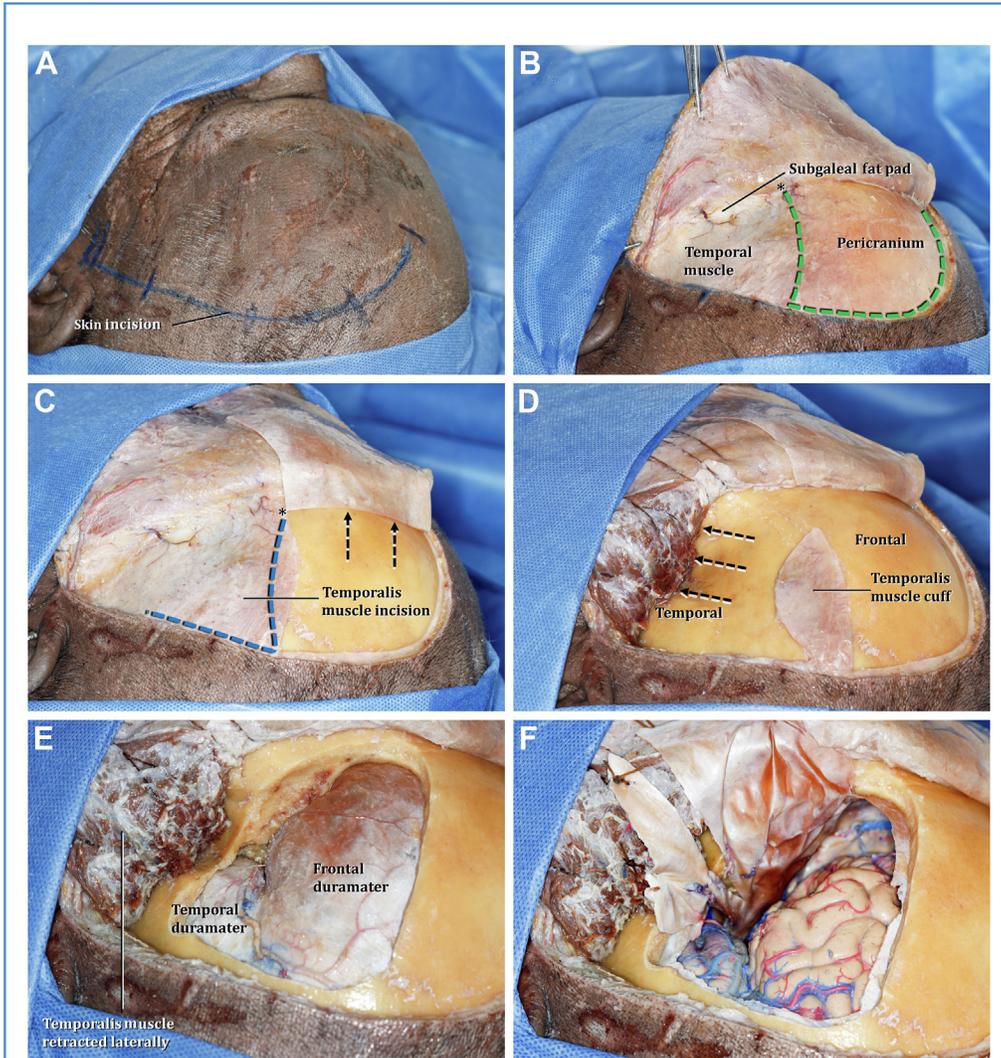


Figure 1. Step-by-step anatomic dissection of the subgaleal preinterfascial dissection in a cadaveric specimen. **(A)** Skin incision: a curvilinear incision, which must be kept behind the implantation hairline, extending from the superior border of the zygoma, 1 cm rostral to the tragus, to the midline, is performed. **(B)** Once the preinterfascial point (*) is identified, the first incision (green dashed line) is carried out parallel to the superior temporal line (STL) (5 mm above) until the posterior border of the approach, where it is continued dorsally to create an anteromedial pericranial flap. **(C)** The pericranial flap is dissected rostrally to expose the frontal bone, and the second incision (blue dashed line) runs parallel to the first ventral to the STL (5 mm

below) until the posterior border of the approach, where it is directed ventrally up to 2 cm above the zygoma. Sectioning of the superficial temporal fascia and temporalis muscle creates an anterolateral muscular flap that allows for muscular mobilization. **(D)** The temporalis muscle is laterally retracted, and the pterional region is completely exposed. A muscular cuff is left attached over the bone flap for reconstruction. **(E)** A conventional pterional craniotomy can be performed without obstructing any soft tissues over the surgical field, with temporal and frontal dura widely exposed. **(F)** The temporal and frontal lobes and the Sylvian fissure can be observed after opening the dura.

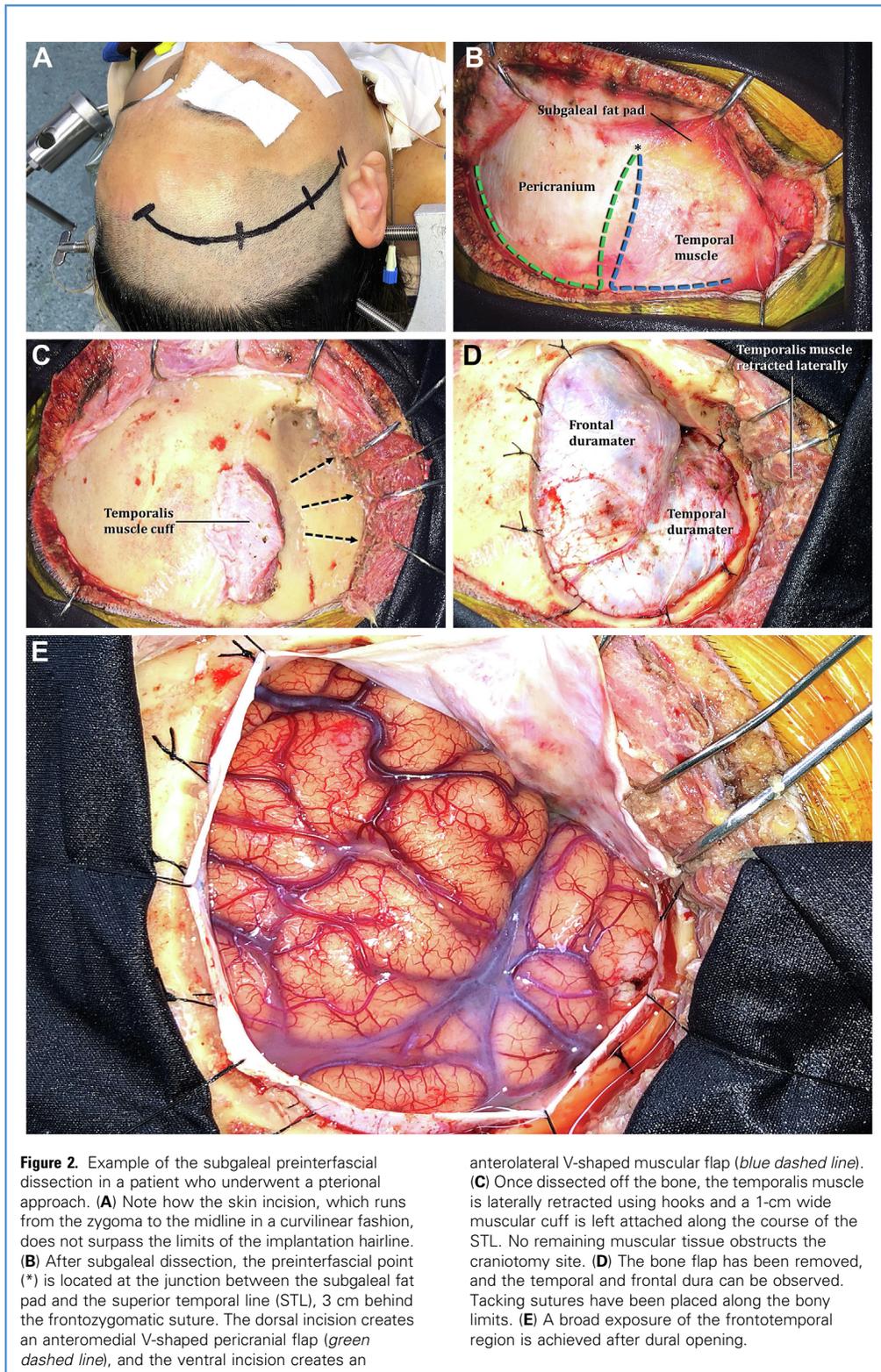


Figure 2. Example of the subgaleal preinterfascial dissection in a patient who underwent a pterional approach. **(A)** Note how the skin incision, which runs from the zygoma to the midline in a curvilinear fashion, does not surpass the limits of the implantation hairline. **(B)** After subgaleal dissection, the preinterfascial point (*) is located at the junction between the subgaleal fat pad and the superior temporal line (STL), 3 cm behind the frontozygomatic suture. The dorsal incision creates an anteromedial V-shaped pericranial flap (green dashed line), and the ventral incision creates an

anterolateral V-shaped muscular flap (blue dashed line). **(C)** Once dissected off the bone, the temporalis muscle is laterally retracted using hooks and a 1-cm wide muscular cuff is left attached along the course of the STL. No remaining muscular tissue obstructs the craniotomy site. **(D)** The bone flap has been removed, and the temporal and frontal dura can be observed. Tacking sutures have been placed along the bony limits. **(E)** A broad exposure of the frontotemporal region is achieved after dural opening.

Table 1. Pathologies Treated Using Subgaleal Preinterfascial Dissection

108 Total Patients
64 Tumors
Meningiomas: 36
Gliomas: 10
Pituitary adenomas: 9
Craniopharyngiomas: 5
Others: 4
24 Aneurysms
6 Arachnoid cysts
5 Cavernomas
3 Arteriovenous malformations
6 Others

simulated in both, and the SPD was performed successfully. In addition, the SPD was carried out uneventfully in 108 patients who underwent a PA for different diseases. Post-operative outpatient follow-up at 1, 3, and 6 months was performed for all cases.

RESULTS

Technique Description

First, a curvilinear skin incision is made starting on the superior border of the zygoma, 1 cm rostral to the tragus, and is superiorly extended toward the superior temporal line (STL), from where it is directed anteriorly until it reaches the midline (Video 1). The incision must be kept behind the implantation hairline to achieve better cosmetic results (Figures 1A and 2A). Dorsal to the STL, the incision should be deep including all the soft tissue from the skin to the pericranium. The latter must be carefully dissected from the flap and attached to the bone. Ventral to the STL, the temporoparietal and superficial temporal fascia (STF) must be kept intact during these initial steps. Dissection should be kept along the subgaleal plane rostrally, following the STL until the preinterfascial point (PIP) is identified.

The PIP is located at the junction of the subgaleal fat pad, between the temporoparietal fascia and STF, and the STL, which is approximately 3 cm behind the frontozygomatic suture (Figure 2B). From this point, the following 2 incisions are performed: the first incision extends dorsal and caudally from the PIP, following the course of the STL (5 mm above it), until the posterior limit of the approach is reached; at this point, the incision is directed dorsal and rostrally, following the direction of the skin incision. This step, which results in an anteromedial V-shaped flap, sections the pericranium and allows its mobilization towards a rostral direction (Figure 1B). The second incision runs parallel to the previous one but along the ventral border of the STL (5 mm below), so a muscular cuff of approximately 1 cm is left between both. Once the posterior

limit of the approach is reached, the incision is directed ventrally up to 2 cm above the upper border of the zygoma (Figure 1C). This results in an anterolateral V-shaped flap, sectioning the STF and the temporalis muscle, which can now be dissected away from the bone in a lateral direction, completely exposing the pterional region (Figures 1D and 2C). The temporal muscle is dissected in a sub periosteal fashion, as described by Oikawa et al.,³ initiating in the posterosuperior quadrant, until the frontozygomatic suture is observed rostrally, and the projection of the middle fossa floor (root of the zygoma) is reached ventrally. Caution must be taken not to leave any portions of the deep temporal fascia attached to the bone, as this may lead to temporal atrophy, thus we do not recommend the use of the monopolar cautery during this crucial step. A conventional pterional craniotomy can be performed with adequate exposure of both the frontal and temporal dura (Figures 1E and 2D), leaving all intradural structures under an unobstructed view (Figures 1F and 2E). The musculoaponeurotic cuff left between the pericranial and muscular flaps along the STL provides an attachment site for closure.

Of the 108 patients operated on with a PA and using the SPD, no evidence of postoperative FTB palsy was found at 1, 3, and 6-month follow-up (Table 1). No complications related to this technique were present and cosmetic results were satisfactory (Figure 3).

DISCUSSION

During anterolateral approaches to the skull, the neurovascular structures in the temporoparietal region are usually put at risk by a lack of proper anatomic knowledge or surgical experience. Anatomic considerations must be taken into account to perform a safe dissection. One of the most important landmarks is the frontal branch of the superficial temporal artery (STA), which usually arises as a single branch in the pre-auricular area approximately 37 mm superior and 17 mm anterior to the tragus, following a superomedial course until reaching the lateral border of the frontal belly of the occipitofrontalis muscle.⁸ Yaşargil⁷ proposed interfascial dissection of the temporal muscle as a route to obtain pterional exposure and

temporal branch preservation of the facial nerve. Regularly, as the frontal branch of the STA, rami frontalis and orbicularis course across the subgaleal fat pad, lying between the loose areolar tissue in between galea and the superficial layer of the temporal fascia and pericranium.⁹ Nevertheless, the aberrant frontalis nerve may cross the interfascial fat pad before it enters the frontalis muscle, for which interfascial dissection of the temporal muscle may present a higher risk of nerve injury, resulting in facial gesture sequelae.¹⁰

The FTB of the facial nerve runs parallel and anteroinferior to the frontal branch of the STA, lying approximately within 1 cm of this vessel, beneath the galea, and above the temporal fascia.^{10,11} Several authors describe subgaleal dissection with the known term *suprafascial dissection*. Sriamornrattanakul et al¹¹ reported an incidence of postoperative frontalis muscle paresis when comparing suprafascial and interfascial techniques. A total number of 11 (20.4%) patients with suprafascial technique presented frontalis paresis in an immediate (<1 month postoperatively) follow-up. On a 3-month follow-up, frontal



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Figure 3. Postoperative follow-up at 1, 3, and 6 months. Cosmetic results are satisfactory in all patients, and

proper eyebrow elevation is observed, rendering no frontotemporal branch of the facial nerve injury.

paralysis remained in 5 patients and resolved after a 6-month follow-up assessment.¹¹ Although the SPD poses no direct manipulation of the structures mentioned earlier (STA and FTB), there is a 30% risk of producing frontalis muscle palsy with a pure subgaleal dissection,¹² which differs from the 0% observed in our series. A similar procedure has been previously described by Miyazawa,¹³ additionally reasoning that muscular atrophy is avoided since the fascia-periosteum complex is intact, aiding nutritional support to the bone flap when reconstructed.

As mentioned before, 3 classical techniques have been used to preserve the FTB, each with pros and cons (Table 2). The SPD is a hybrid dissection that fuses the advantages of these 3 techniques, as it allows for the broad pterional exposure provided by the interfascial dissection, while the FTB is adequately preserved as in the myocutaneous and subfascial approaches. We consider that the SPD may be

used for any intracranial pathology that is deemed treatable via a pterional approach because no limitations within the surgical exposure were found to decrease visualization or maneuverability.

Limitations

This study does not imply the SPD to be superior to any of the other techniques herein described; only a description of this technique and our clinical results are provided. Further investigation comparing the clinical results amongst all of the techniques should be performed.

CONCLUSION

SPD is a simple, reliable, and affordable technique that can be applied in any operating room and over any patient being operated on via a pterional approach. It provides excellent cosmetic

Table 2. Frontotemporal Branch (FTB) Preservation Techniques Comparison

Techniques	Pros	CONS
Myocutaneous flap: en bloc mobilization of soft tissues including all the way from skin to temporalis muscle along with its fascias	Risk of FTB injury is virtually negligible	Less exposure, as visualization of the pterional region is obscured by a huge muscle bulge
Subfascial dissection: the STF and DTF, with the interfascial fat pad in between, are mobilized along with the skin flap, leaving the lateral portion of the temporalis muscle exposed	Low risk of FTB injury	Subperiosteal exposure becomes difficult along the zygomatic arch and orbital rim because this is the least anatomic approach
Interfascial dissection: initially, a subgaleal dissection; however, 3 cm before the orbital rim, the STF and the interfascial fat pad are sectioned and mobilized anteroinferiorly with the skin flap	Best pterional exposure, as this is the most anatomic approach	Poses the highest risk of FTB injury, especially if not performed correctly

STF, superficial temporal fascia; DTF, deep temporal fascia.

and functional results while offering an excellent surgical view over the pterional region, preserving the facial nerve FTB functionality and avoiding temporal muscle atrophy.

CRedit AUTHORSHIP CONTRIBUTION STATEMENT

Marcos V. Sangrador-Deitos: Conceptualization, Supervision, Project administration, Formal analysis. **Rodrigo Uribe-Pacheco:** Conceptualization, Supervision, Project administration, Formal

analysis. **Gerardo Y. Guinto-Nishimura:** Conceptualization, Software, Investigation, Writing – original draft, Writing – review & editing. **Martín Paíz:** Conceptualization, Software, Investigation, Writing – original draft, Writing – review & editing. **Matías Baldoncini:** Conceptualization, Software, Investigation, Writing – original draft, Writing – review & editing. **Juan Villalonga:** Software, Investigation, writing. **Alvaro Campero:** Conceptualization, Supervision, Project administration, Formal analysis.

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