

Combined transpalpebral and endonasal approach for the treatment of frontal sinus, orbital, and supraorbital cell pathology: evaluation of surgical exposure

Abstract

Objective: To determine whether a combined transpalpebral and endonasal surgical approach allows adequate exposure of the frontal sinus (medial and lateral sectors), the supra-orbital cells, and the orbital roof, and to evaluate the cosmetic outcome of the superior palpebral incision.

Study design: Descriptive, retrospective, observational case-series study, reported following the PROCESS guidelines. Level of evidence IV.

Methods: Preoperative coronal computed tomography scans were analyzed, and the frontal sinus was divided into a medial and a lateral sector using a vertical line drawn at the level of the supraorbital pedicle. During surgery, the degree of exposure obtained in the medial and lateral frontal sinus, the supraorbital cells, and the orbital roof was assessed separately using a predefined four-category ordinal scale, applied by the operating surgeon. The cosmetic outcome of the palpebral incision was assessed by the surgical team using an ordinal scale, without independent or patient-reported evaluation.

Results: Seven patients treated for inflammatory/infectious disease of the frontal sinus, supraorbital cells, or orbit were included: five presented with a superior subperiosteal orbital abscess and two with complicated frontal sinusitis originating in the supraorbital cell. All patients underwent a transpalpebral approach combined with a Draf II or III endonasal frontal drainage procedure. Exposure of the medial and lateral frontal sinus, orbital roof, and supraorbital cells, when involved, was rated adequate (+++) in all cases by the operating team. The cosmetic outcome of the transpalpebral incision was satisfactory in all patients. Two of the seven patients — both with disease originating in the supraorbital cell — experienced recurrence at that site and required revision surgery consisting of a transpalpebral approach with resection of the cell mucosa and fat obliteration (“mini-obliteration”). One patient with allergic fungal rhinosinusitis had an intraoperative cerebrospinal fluid leak during endonasal removal of allergic mucin adherent to the dura, which was repaired intraoperatively with an intracranial fat graft and an extracranial septal mucosal graft, with no reported postoperative sequelae. Median follow-up was 18 months (range 12–84 months).

Conclusion: In this small, retrospective case series, the combined transpalpebral and endonasal Draf-type approach was technically feasible and provided adequate surgical exposure of the lateral frontal sinus, orbital roof, and supraorbital cells, with a satisfactory cosmetic outcome. Two of seven patients with supraorbital cell disease developed recurrence requiring revision surgery, and one patient had an intraoperative cerebrospinal fluid leak that was successfully repaired. Given the small sample size, heterogeneous etiology, absence of a comparison group, and unblinded assessment of outcomes, these findings should be regarded as hypothesis-generating; whether this combined approach reduces the need for more invasive procedures compared with alternative techniques cannot be determined from this series and requires evaluation in larger, prospective, comparative studies.

Keywords: frontal sinus, frontal sinusitis, orbital abscess, transpalpebral approach, endoscopic sinus surgery, Draf III, supraorbital ethmoid cell

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Introduction

Surgical management of the frontal sinus represents a technical challenge, particularly for lesions involving its lateral sector and for pathology localized in the orbit and supraorbital cells. Despite advances in endoscopic surgery, anatomical variations can hinder and limit access to the lateral sectors of the sinus when only a Draf-type endonasal approach is performed, even when angled endoscopes are used.

With the modified Lothrop technique (Draf III), there may be limitations in exposing the lateral sector of the sinus or in dissecting laterally with forceps, curettes, or drills.

External approaches combined with Draf II or III frontal drainage can improve exposure and facilitate the dissection and resection of pathology located laterally in highly pneumatized sinuses, in the orbital roof, or in the supraorbital cells. The transpalpebral approach is a minimally invasive technique that facilitates exposure of these regions.

Objective

To determine whether exposure of the frontal sinus (medial and lateral sectors), the supraorbital cells, and the orbital roof was adequate using a combined transpalpebral and endonasal surgical approach, and to evaluate the cosmetic outcome of the superior palpebral approach.

Materials and Methods

Study design

Descriptive, retrospective, observational case-series study. The PROCESS guidelines for observational studies were followed and correspond to a level IV study (case series).

A retrospective analysis was performed of patients treated with a combined endonasal and transpalpebral approach for inflammatory disease of the frontal sinus, supraorbital cells, or orbit at the Hospital Italiano de Buenos Aires between March 2016 and October 2024. All consecutive patients meeting the inclusion criteria during this period were identified through review of the surgical registry of the Rhinology and Skull Base Section.

All patients treated with a combined transpalpebral-endonasal approach for inflammatory/infectious pathology of the frontal sinus, supraorbital cell, or orbit during the study period were included. Patients with postoperative follow-up of less than 3 months, those who underwent purely endoscopic or purely external approaches, or those with incomplete clinical records were excluded.

Electronic medical records were reviewed, and the following data were collected in a spreadsheet: age, sex, underlying diagnosis, prior sinus or craniofacial surgery, location of disease within the frontal sinus, supraorbital cell, or orbit, initial and, when applicable, revision surgical approach, degree of exposure by anatomical site, intraoperative and postoperative complications, recurrence, cosmetic outcome of the transpalpebral approach, and follow-up time.

Surgical exposure scale

The degree of surgical exposure was recorded separately for four anatomical sites — the medial frontal sinus, the lateral frontal sinus, the orbital roof, and the supraorbital cell (when involved) — using a four-category ordinal scale defined prospectively by the senior author before data collection: 0, the site could not be visualized or instrumented; + (poor), the site was partially visualized but could not be safely instrumented with suction, curette, or drill; ++ (fair), the site was visualized and partially instrumented, with residual disease that could not be confidently cleared; +++ (adequate), the site was fully visualized and instrumented, allowing complete removal of disease under direct or endoscopic vision. The assessment was performed intraoperatively by the operating surgeon; no independent or blinded assessment of exposure was performed, which is acknowledged as a limitation below.

Cosmetic outcome scale

The cosmetic outcome of the palpebral incision was classified using a four-category ordinal scale: – (unfavorable), eyelid retraction or keloid scar; +, visible scar; ++, minimally visible scar; +++, imperceptible scar. Standardized photographs were taken 3 months

after surgery and reviewed independently by the treating surgeon and two other members of the surgical team, none of whom were blinded to the procedure performed; consensus among the three raters was 100%. No patient-reported cosmetic outcome measure was used; this is acknowledged as a limitation.

No statistical analysis was performed given the small sample size.

All patients were evaluated by office-based nasal endoscopy and non-contrast facial computed tomography with 1-mm slices.

A vertical line was drawn at the level of the supraorbital vascular pedicle to divide the frontal sinus into a medial and a lateral sector. During surgery, it was determined whether the combined approach allowed adequate exposure of the aforementioned regions (Figure 1).



Figure 1 Coronal computed tomography: Vertical line drawn at the level of the supraorbital pedicle, dividing the frontal sinus into a medial and a lateral sector.

Patients with subperiosteal orbital abscesses were treated with intravenous ampicillin-sulbactam until symptoms improved following surgical drainage. Treatment was then switched to the oral route, completing 21 days of therapy. The remaining patients with complicated bacterial frontal sinusitis had received prior treatment at other centers with various antibiotics, and the regimen was adjusted according to the culture and antibiogram of the material obtained during surgery.

Surgical technique

A 2.5- to 3-cm skin incision was made in the upper eyelid along a natural palpebral fold, following the supratarsal crease. It began medially at the level of the medial canthus (avoiding the lacrimal pathway) and was extended laterally as needed. The orbicularis muscle was incised, and dissection proceeded in the submuscular preseptal plane, exposing the orbital septum without injuring it.

Dissection was advanced superiorly to the superior orbital rim, identifying and preserving the supraorbital neurovascular bundle. At this level, the periosteum was incised and elevated with a suction-dissector cannula toward the anterior table of the frontal sinus or toward the orbital roof, performing a superior orbitotomy. Frontal trephination was performed, or the region eroded by infection in the anterior table or floor of the frontal sinus was enlarged using polishing burrs.

A Draf II or III endonasal approach to the frontal sinus was performed through an endonasal access (Figure 2).

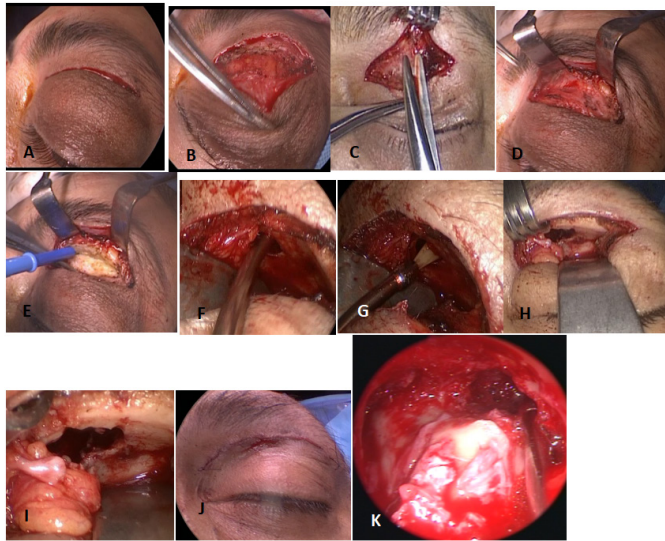


Figure 2 Combined approach: superior transpalpebral with frontal trephination and modified Lothrop procedure. A: skin incision of the eyelid; B: incision of the orbicularis muscle and submuscular preseptal dissection; C: preseptal dissection; D-E: identification of the orbital rim and periosteal incision; F-H: subperiosteal dissection and superior orbitotomy, with visible erosion of the orbital roof (frontal sinus floor) and aspiration of purulent secretions; H-I: enlargement of the eroded area to improve lateral frontal access; J: intradermal suture of the palpebral incision; K: endonasal view of the Draf III or modified Lothrop frontal drainage.

Results

Seven patients were treated with the combined transpalpebral-endonasal approach for infections involving the frontal sinus, the

anterior skull base, the supraorbital cell, or the orbit between March 2016 and October 2024. Patient-level details are summarized in Table 1 and described individually below; each patient is referred to consistently as Patient 1 through Patient 7.

Five patients (Patients 4–7) presented with a superior subperiosteal orbital abscess complicating frontal sinusitis or, in one case, allergic fungal rhinosinusitis. Two patients (Patients 2 and 3) presented with complicated frontal sinusitis originating in the supraorbital cell. Four patients (Patients 1–4) had frontal sinuses with lateral pneumatization extending beyond the vertical line drawn at the level of the supraorbital pedicle.

Three patients had a history of prior sinus or craniofacial surgery: Patient 1 had undergone osteoplastic frontal sinus surgery with obliteration on two prior occasions (22 and 25 years earlier); one further patient had a craniotomy involving the frontal sinus with obliteration for neurosurgical pathology 12 years earlier, and one further patient had undergone osteosynthesis with titanium microplates for a facial fracture compromising frontal and ethmoidal drainage 4 years earlier.

Patients 2 and 3 (63 and 17 years old, respectively) presented with complicated frontal sinusitis originating in the supraorbital cell. Patient 2 underwent Draf III frontal drainage, and Patient 3 underwent Draf III, each combined with a unilateral transpalpebral approach to drain the supraorbital cell into the nasal cavity; Patient 2 additionally had a concurrent superior orbital abscess. Both patients subsequently developed recurrence at the supraorbital cell and required revision surgery, consisting of a transpalpebral approach to the supraorbital cell, resection of the cell mucosa, drilling of the bony cavity, and obliteration with autologous fat — a procedure the authors termed “mini-obliteration” (Figure 3). The exposure and cosmetic outcomes reported in Table 1 for these two patients correspond to the combined approach used at the time of the revision surgery.

Table 1 Patients treated with combined endonasal (Draf II or III) and transpalpebral approach with frontal trephination

Pt	Diagnosis	Age/Sex	Prior surgery	Frontal sinus / supraorbital cell / orbit involvement	Initial approach	Exposure (medial FS / lateral FS / orbital roof / SOC)	Complications / recurrence & revision
1	Recurrent frontal sinusitis after failed osteoplastic obliteration, lateral pneumatization	58 / M	Osteoplastic frontal sinus obliteration x2 (22 and 25 y earlier)	FS: medial+lateral, orbital erosion. SOC: no. Orbit: no abscess	Draf III alone (removal of obliteration material, ventilation)	+++ / +++ / N/A / N/A	No intraoperative complication. Recurrence 5 years after initial ventilation → revision with combined Draf III + TP (data reported here)
2	Complicated frontal sinusitis originating in the supraorbital cell, with superior orbital abscess	63 / M	Craniotomy with frontal sinus obliteration	FS: medial+lateral, orbital/frontal roof erosion. SOC: yes. Orbit: abscess	Draf III + unilateral TP + ethmoidectomy, drainage of SOC and orbital abscess	+++ / +++ / +++ / +++	No intraoperative complication. Recurrence at the supraorbital cell → revision: TP approach, resection of SOC mucosa, drilling, fat “mini-obliteration”
3	Complicated frontal sinusitis originating in the supraorbital cell	17 / M	Osteosynthesis for facial fracture	FS: medial+lateral, orbital erosion. SOC: yes. Orbit: no abscess	Draf II + unilateral TP + ethmoidectomy, drainage of SOC	+++ / +++ / +++ / +++	No intraoperative complication. Recurrence at the supraorbital cell → revision: TP approach, resection of SOC mucosa, drilling, fat “mini-obliteration”

4	Allergic fungal rhinosinusitis, bilateral, with skull-base erosion and left orbital abscess	49 / M	None reported	FS: bilateral, medial+lateral, skull-base erosion. SOC: no. Orbit: left abscess	Draf III + bilateral TP, removal of allergic mucin, drainage of orbital abscess	+++ / +++ / +++ / N/A	Intraoperative CSF leak during endonasal removal of mucin adherent to the dura; repaired intraoperatively with intracranial extradural fat graft and extracranial septal mucosal graft. No postoperative sequelae reported. No recurrence
5	Superior subperiosteal orbital abscess	13 / F	None reported	FS: medial. SOC: no. Orbit: abscess	Draf II + unilateral TP	+++ / N/A / +++ / N/A	None reported
6	Superior subperiosteal orbital abscess	55 / F	None reported	FS: medial. SOC: no. Orbit: abscess	Draf II + unilateral TP	+++ / N/A / +++ / N/A	None reported
7	Superior subperiosteal orbital abscess	56 / M	None reported	FS: medial. SOC: no. Orbit: abscess	Draf II + unilateral TP	+++ / N/A / +++ / N/A	None reported

FS: frontal sinus. SOC: supraorbital cell. TP: transpalpebral. CSF: cerebrospinal fluid. Exposure scale: 0 = could not be exposed, + = poor, ++ = fair, +++ = adequate, N/A = site not involved.

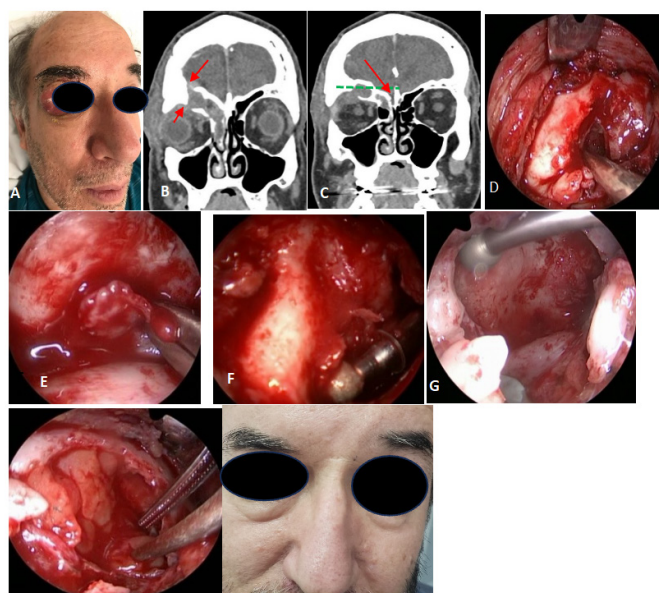


Figure 3 Mucocoele originating in the supraorbital cell. A: spontaneous drainage of the superior orbital abscess; B: coronal facial CT scan showing right fronto-ethmoidal opacification and erosion of the floor and superior wall of the frontal sinus, with a superior orbital abscess; C: coronal CT showing opacification of the supraorbital cell with a superior orbital abscess; D: frontal trephination via a superior transpalpebral approach; E: resection of the supraorbital cell mucosa; F-G: drilling of the supraorbital cell via the nasal route and frontal trephination; H: fat obliteration of the supraorbital cell; I: postoperative view, with no evidence of palpebral scarring

Patient 1, with a history of two prior osteoplastic frontal sinus procedures with obliteration, underwent removal of the obliteration material and ventilation of the sinus using an endonasal Draf III procedure alone. Five years later, this patient presented with recurrence of lateral frontal sinus disease, and revision surgery combining the endonasal approach with a transpalpebral approach was performed to access the most lateral sector of the frontal sinus and achieve drainage into the nasal cavity; no further recurrence has been observed to date.

Patient 4 presented with allergic fungal rhinosinusitis involving all paranasal sinuses, with bone erosion of the skull base. A bilateral transpalpebral approach combined with Draf III endonasal frontal drainage was performed to remove the allergic mucin from the frontal sinus, and an associated left orbital abscess was drained through the external approach. This patient had an intraoperative complication during the endonasal portion of the procedure — a cerebrospinal fluid leak — which occurred while resecting mucin adherent to the dura mater; it was repaired intraoperatively with a fat graft placed in the intracranial extradural space and an extracranial septal mucosal graft. No postoperative cerebrospinal fluid leak, meningitis, or other sequelae were observed during follow-up.

Patients 5, 6, and 7 had complicated frontal sinusitis with a superior subperiosteal orbital abscess; each underwent Draf II endonasal frontal drainage combined with a transpalpebral approach to drain the abscess (Figure 4).

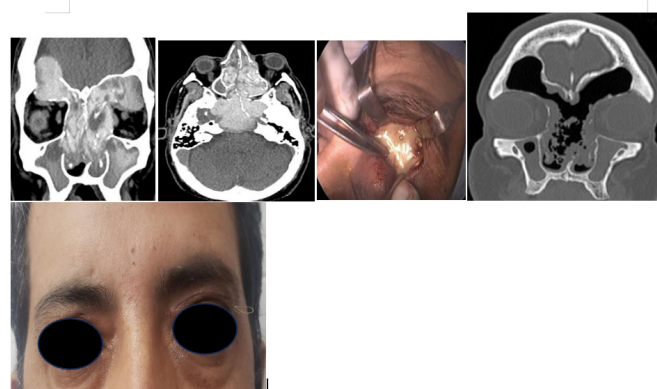


Figure 4 Allergic fungal rhinosinusitis. A: coronal CT showing bone erosion of the right frontal roof and floor, extradural intracranial extension of the allergic mucin, and left orbital involvement with abscess; B: axial slice showing extensive bone erosion of the skull base; C: drainage of the orbital abscess via a superior palpebral approach; D: immediate postoperative CT; E: intradermal suture of the bipalpebral incision, 7 days after surgery.

Exposure of the medial and lateral frontal sinus (when pneumatization extended laterally), the supraorbital cell (when

involved), and the orbital roof (when involved) was rated adequate (+++) by the operating surgeon in every site assessed; a site-by-site breakdown is given in (Table 1). Healing of the palpebral incision was rated satisfactory (+++) in all seven patients. Beyond the two supraorbital cell recurrences and the intraoperative cerebrospinal fluid leak described above, no additional recurrences, mucoceles, visual complications, diplopia, eyelid dysfunction, sensory disturbances, or unplanned reoperations were recorded during follow-up. Median follow-up was 18 months (range: 12–84 months).

Discussion

Surgical approaches to the frontal sinus have evolved, over the past several decades, from external procedures toward endonasal ones. This was made possible by technological advances — 0° and angled endoscopes, high-definition cameras, instruments suited for working within the frontal sinus, and neuronavigation — and by the greater experience acquired by surgical teams in skull base surgery, allowing techniques described in the past century, such as the procedure described by Lothrop in 1914¹ and later refined as the modified Lothrop procedure or Draf III,^{2,3} to be revived and applied to complex frontal pathology. This approach superseded external osteoplastic surgery with fat obliteration, described by Tato and Bergaglio in 1954,⁴ which had been the mainstay of frontal sinus surgery for decades, given the failure rate (10%)⁵ and rate of late mucocoele formation (9.4%) associated with obliteration.⁶

An exclusively endonasal approach to the frontal sinus may be inadequate when the distance between the nasal bones and the ethmoid cribriform plate is less than 1 cm, in the presence of neo-osteogenesis, when the frontal sinus shows excessive lateral pneumatization, when pathology extends laterally or lateral septa are present, or when supra-agger nasi, supra-bulla frontal, or supraorbital cells are involved.⁷ In these situations, combining the endonasal approach with an external one, such as the transpalpebral approach, may be useful; as noted by Hahn et al.⁸ external approaches retain an important role in refractory or laterally located frontal pathology despite advances in endoscopic technique.

The transpalpebral approach uses the superior palpebral fold to conceal the incision and offers a cosmetic alternative to traditional brow, sub-brow, or bicoronal incisions.^{9,10} A meta-analysis of 70 articles found the supramuscular-plane superior blepharoplasty approach to be associated with a lower risk of injury to adjacent tissue and shorter operative time than the submuscular approach, and reported favorable cosmetic outcomes compared with bicoronal and other periorbital incisions.¹¹ In our series, using the traditional submuscular preseptal technique, no local complications related to the palpebral incision were recorded and the cosmetic outcome was rated satisfactory in all cases by the surgical team, though this assessment was not independent or patient-reported, which limits its interpretation.

Cadaveric studies help contextualize our intraoperative findings. Steele et al. divided the frontal sinus into three zones on computed tomography and found that a modified Lothrop procedure alone provided excellent access to the medial two zones but limited visualization of the posterior wall laterally, while a transpalpebral approach achieved 100% exposure of the most lateral zone; combining both techniques allowed access to all walls and zones.¹² Similarly, Timperley et al. found that access to the frontal sinus floor (orbital roof) via an endonasal modified Lothrop approach alone was achieved in only 35% of specimens overall, decreasing further with increasing lateral pneumatization, and recommended combining

trephination or osteoplastic surgery with the endonasal approach for laterally extensive disease.¹³ These findings are consistent with our rationale for adding a transpalpebral approach in patients with lateral pneumatization, supraorbital cell disease, or orbital roof involvement, and with the report by Eloy et al. of a type IIC frontal drainage modification aimed at improving lateral exposure through the endonasal route alone.¹⁴ Other authors have similarly concluded that sinuses with a reduced anteroposterior diameter and extensive horizontal diameter are difficult to manage endoscopically alone and benefit from an associated external approach.¹⁵

The “mini-obliteration” technique used here for recurrent supraorbital cell disease adapts, on a smaller scale and at a different anatomical site, the classical concept of fat obliteration described by Tato and Bergaglio in our country.⁴ We use this term descriptively rather than as a validated technique: it was applied in only two patients in this series, both of whom had already failed an initial combined procedure, and its effectiveness beyond the follow-up reported here has not been established.

Limitations

This study has several important limitations. It is a retrospective, descriptive case series without a comparison group, and the sample size is small ($n = 7$), which precludes statistical analysis and subgroup-specific conclusions. The series is etiologically heterogeneous, including complicated bacterial sinusitis, allergic fungal rhinosinusitis, and disease recurring after prior sinus or craniofacial surgery. The degree of surgical exposure and the cosmetic outcome were both assessed by members of the treating surgical team without blinding or independent, patient-reported evaluation, introducing a clear risk of observer bias; this applies in particular to the subjective judgment of what constitutes “adequate” exposure. Follow-up time was not standardized (range 12–84 months), which limits the ability to detect late recurrences or mucoceles equally across patients. Two of the seven patients experienced recurrence requiring revision surgery, and this recurrence rate, together with the single intraoperative cerebrospinal fluid leak, should be interpreted with caution given the small number of patients at risk. Finally, because all patients in this series were selected for a combined approach, this study cannot determine whether the addition of a transpalpebral approach altered outcomes compared with an endonasal-only strategy, nor whether it reduces the need for more invasive procedures; such comparisons would require a prospective, comparative design. For these reasons, the level of evidence of this study corresponds to a case series (level IV), and its findings should be interpreted as hypothesis-generating.

Conclusion

In this small, retrospective case series, the combined transpalpebral approach with trephination and endonasal Draf-type drainage was technically feasible and provided adequate intraoperative exposure of the lateral frontal sinus, the orbital roof, and the supraorbital cells, with a satisfactory cosmetic outcome of the palpebral incision. Two patients with supraorbital cell disease developed recurrence requiring revision surgery with fat “mini-obliteration,” and one patient had an intraoperative cerebrospinal fluid leak that was successfully repaired without sequelae. Based on this experience, the combined approach may be considered in patients with lateral pneumatization of the frontal sinus, laterally located pathology, orbital roof involvement, or infection localized to the supraorbital cells. Whether this approach reduces the need for more invasive procedures, or compares favorably with alternative techniques, cannot be established from this uncontrolled series and should be evaluated in larger, prospective,

comparative studies with standardized, ideally blinded, assessment of exposure and cosmetic outcome.

Ethics approval and consent

This study was approved by the Institutional Review Board / Ethics Committee of Hospital Italiano de Buenos Aires (approval number: 7484, PRIISA file: 16042, June 30, 2025). Written informed consent for the surgical procedures and for the use of clinical images was obtained from all patients or, in the case of the minor patients, from their legal guardians, together with the patients' assent where applicable.

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Competing interests

Authors have declared that no competing interests exist.

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