

Frontal Mucoceles: Two Cases Managed with a Combined Approach and a Narrative Review

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Abstract

Original Research Article

Paranasal sinus mucoceles are epithelium-lined cystic lesions caused by obstruction of sinus drainage; they may progressively expand with bony remodeling or erosion and can lead to orbital or intracranial complications (Capra *et al.*, 2012; Scangas *et al.*, 2013; Lund & Milroy, 1991). We report two frontal sinus mucoceles treated surgically in our department in 2022 and provide a narrative review focused on surgical route selection and complication prevention. Both patients presented with a cosmetically deforming supraorbital swelling (with mild exophthalmos in one case); likely etiologies were chronic rhinosinusitis with nasal polyps/aspirin-exacerbated respiratory disease and remote facial trauma. A combined strategy (limited eyebrow incision for direct evacuation plus endonasal frontal sinusotomy (Draf II) to establish durable drainage, with temporary catheter placement) resulted in rapid clinical improvement, with no clinical recurrence after 15–18 months of follow-up. Endoscopic marsupialization remains the standard of care for most mucoceles; however, in selected frontal mucoceles with marked anterior table bulging/erosion, lateral/supraorbital extension, or difficult endonasal access, a combined approach can help secure drainage while preserving cosmesis.

Keywords: mucocele, frontal sinus, endoscopic surgery, frontal sinusotomy, Draf II, combined approach, orbital extension.

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INTRODUCTION

Paranasal sinus mucoceles are epithelium-lined cystic lesions related to obstruction of the drainage ostium (chronic inflammation, nasal polyposis, prior surgery, trauma, and more rarely tumors). They progress slowly, leading to sinus expansion and bony remodeling or erosion, which may result in orbital or intracranial complications (Capra *et al.*, 2012; Scangas *et al.*, 2013; Lund & Milroy, 1991). The frontal sinus and fronto-ethmoidal complex are the most frequently involved sites (Capra *et al.*, 2012; Scangas *et al.*, 2013).

The aim of this report is to describe two frontal mucoceles managed with a combined approach and to discuss, in light of recent evidence, the selection of the surgical route (endonasal versus external/combined), indications for frontal procedures (Draf II/III), and follow-up strategies.

MATERIALS AND METHODS

This retrospective case series includes two patients who underwent surgery for frontal sinus mucocele in our department in 2022. Collected variables included relevant history (chronic rhinosinusitis with/without nasal polyps, prior surgery, trauma), clinical presentation (frontal deformity, orbital or neurologic symptoms), imaging (systematic CT; MRI when extension beyond the sinus was suspected), surgical technique (type of frontal sinusotomy, external access when used, temporary catheter/stent when used), postoperative care, and outcome (clinical course, endoscopic surveillance, recurrence). A narrative (non-systematic) literature review was performed using PubMed and Google Scholar with the following keywords: “frontal mucocele”, “paranasal sinus mucocele”, “Draf II”, “Draf III/modified endoscopic Lothrop”, “combined approach”, and “anterior/posterior table erosion”. Reference lists of key articles were also screened to capture additional relevant series.

RESULTS

Case 1

A 30-year-old woman with aspirin-exacerbated respiratory disease (asthma and chronic rhinosinusitis with nasal polyps) and no history of facial trauma presented with a progressively enlarging right

supraorbital swelling causing cosmetic impairment, associated with mild exophthalmos without diplopia.

On examination, the swelling was firm, non-tender, and approximately 3 cm in diameter. Exophthalmos was non-axial with preserved ocular motility; visual acuity was maintained. Nasal endoscopy showed bilateral nasal polyposis.



Figure 1: Preoperative clinical appearance (frontal and profile views): right supraorbital swelling

Facial CT demonstrated diffuse sinonasal opacification consistent with polyposis, associated with complete opacification of the right frontal sinus with

expansile changes and bulging/erosion of the anterior table, without clear evidence of intracranial extension.

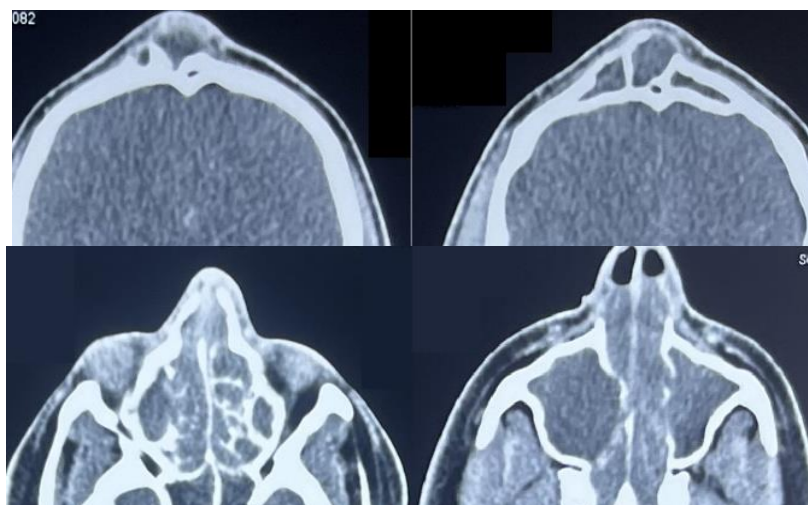


Figure 2: CT (axial images): frontal sinus opacification with anterior table bulging/erosion, and nasal cavity opacification due to polyposis



Figure 3: Right exophthalmos (grade I)

The patient underwent functional endoscopic sinus surgery (polypectomy and bilateral middle meatal antrostomy), combined with a right eyebrow incision (hidden within the brow) allowing frontal sinus opening and evacuation of mucopurulent content. An endonasal Draf II frontal sinusotomy was then performed to re-establish wide drainage through the frontal recess. A temporary catheter was left across the frontonasal drainage pathway to reduce the risk of early restenosis.

A sample of the collected content was sent for bacteriological analysis. Postoperative antibiotic therapy was prescribed and adjusted according to culture results when available. Postoperative course was uneventful. Endoscopic follow-up was scheduled every two months, and the catheter was removed at 8 weeks. Clinical outcome was favorable, with resolution of swelling and exophthalmos and no clinical recurrence at 18 months.



Figure 4: Postoperative clinical appearance: resolution of frontal swelling

Case 2

A 52-year-old woman reported a remote fall with facial trauma that had not been investigated at the

time. She presented with a progressively enlarging right supraorbital swelling associated with local discomfort, without fever or neurologic symptoms.

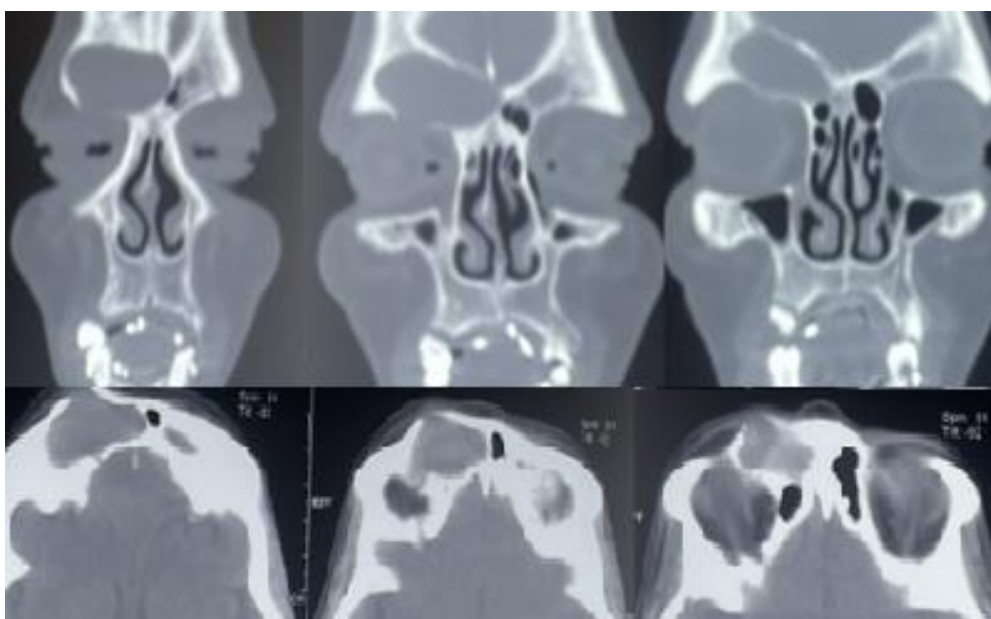


Figure 5: CT (axial and coronal images): right frontal mucocele with intraorbital extension and elevation of the overlying soft tissues



Figure 6: MRI (sagittal FLAIR): contact between the mucocele and the superior rectus muscle with mild impression on the frontal lobe

CT and MRI confirmed a well-circumscribed right frontal sinus lesion ($20 \times 37 \times 21$ mm) consistent with a mucocele/mucopyocele, with orbital extension. On MRI, signal was heterogeneous on T1- and T2-weighted images; diffusion sequences did not show overt restriction.

The patient underwent septoplasty followed by endonasal Draf II marsupialization. In addition, a right eyebrow frontal sinusotomy allowed evacuation of the content and direct inspection of the sinus cavity, which was considered helpful given orbital extension. A

catheter was placed through the frontonasal drainage pathway and retrieved into the right nasal cavity under endoscopic guidance.

A sample of the mucopyocele content was sent for bacteriological analysis. Postoperative antibiotic therapy was prescribed and adjusted according to culture results when available. Postoperative course was uneventful. Endoscopic follow-up was scheduled every two months, and the catheter was removed at 8 weeks. At 15 months, the frontal swelling had resolved with no clinical recurrence.



Figure 7. Postoperative clinical appearance: resolution of the right supraorbital swelling

DISCUSSION

Mucoceles result from obstruction of sinus drainage (chronic inflammation, nasal polyposis, surgery, trauma), leading to progressive mucus accumulation and sinus expansion (Capra *et al.*, 2012; Scangas *et al.*, 2013). Bony remodeling and osteolysis, long attributed to pressure alone, also appear to involve local inflammatory mechanisms (Lund & Milroy, 1991).

In a clinical review, Scangas *et al.* reported a mean delay of several years between prior endoscopic surgery, trauma, or open surgery and mucocele diagnosis, underscoring the indolent, late presentation (Scangas *et al.*, 2013).

Clinical presentation depends on location and extension. Frontal/fronto-ethmoidal mucoceles often manifest as supraorbital deformity, frontal pain,

exophthalmos, or ocular motility disorders. Systematic assessment for orbital and neurologic signs is essential, as complications have been reported (Capra *et al.*, 2012; Scangas *et al.*, 2013).

Imaging is central for diagnosis and extension assessment. CT is the reference examination to evaluate bony changes, frontal recess anatomy, and surgical landmarks. MRI is useful when orbital or intracranial extension is suspected and to help differentiate mucocèles from other expansile lesions (e.g., neoplasm, encephalocele) when the diagnosis is uncertain (Capra *et al.*, 2012; Scangas *et al.*, 2013).

Endoscopic marsupialization is currently the standard treatment, with high control rates and reduced morbidity (Kennedy *et al.*, 1989; Har-El, 2001; Serrano *et al.*, 2004; Bockmühl *et al.*, 2006; Obeso *et al.*, 2009). The therapeutic goal is to restore durable sinus drainage rather than to excise the entire mucosa. Frontal mucocèles are particularly challenging due to variable frontal recess anatomy, possible lesion lateralization, and bony remodeling (neo-osteogenesis). Endoscopic frontal procedures (Draf I–III) provide stepwise widening of the drainage pathway; Draf III (modified endoscopic Lothrop) is effective for complex or recurrent disease, with long-term patency dependent on meticulous technique and postoperative care (Hurley *et al.*, 2000; Sama *et al.*, 2014; Georgalas *et al.*, 2011; Khong *et al.*, 2004; Noller *et al.*, 2022; DeConde & Smith, 2016).

Recent series suggest that anterior and/or posterior table dehiscence does not systematically mandate an external route: endoscopic marsupialization may be sufficient in many cases, including those with anterior table erosion (Woodworth *et al.*, 2008; Sama *et al.*, 2014). Sama *et al.* proposed an algorithm incorporating lesion position (medial/intermediate/lateral) and escalation factors (drainage pathway dimensions, fronto-ethmoidal cells, neo-osteogenesis) to guide selection among endonasal surgery, Draf III, or more rarely an external approach (Sama *et al.*, 2014).

A combined approach (limited external access plus endonasal surgery) remains useful in selected situations: marked anterior table bulging/erosion, very lateral/supraorbital mucocèles, difficult endonasal access, major frontal recess obstruction, post-surgical scarring, or the need to directly control orbital extension. Our two cases illustrate this strategy, combining eyebrow evacuation with wide endonasal marsupialization (Draf II) to secure drainage (Chiu & Vaughan, 2004). The use of a temporary catheter/stent remains debated: available data suggest potential benefit in selected high-risk settings but also a non-negligible complication burden, so indications should be individualized and follow-up should be close (Khan *et al.*, 2020; Bandino *et al.*, 2024).

Long-term follow-up is recommended. Reported risk factors for recurrence include surgery

performed during acute infection, multiple mucocèles, and extensive extra-sinus extension (Picavet & Jorissen, 2005). Regular endoscopic surveillance and control of underlying chronic rhinosinusitis (particularly in patients with nasal polyposis) are essential.

Practical points: (i) treat the underlying inflammatory driver (e.g., chronic rhinosinusitis with nasal polyps) alongside mucocèle drainage; (ii) ensure a sufficiently wide, mucosa-preserving frontal opening whenever feasible; (iii) reserve combined/external assistance for situations where endonasal access is limited or when direct evacuation/inspection is valuable for orbital or anterior table involvement; (iv) schedule long-term endoscopic surveillance because delayed recurrence can occur.

CONCLUSION

Early diagnosis of frontal mucocèles relies on imaging, particularly CT, to anticipate orbital or intracranial complications. Endoscopic marsupialization is the treatment of choice. A well-executed combined approach remains appropriate when endonasal access is limited or when the lesion is markedly lateralized, allowing durable drainage and satisfactory cosmetic outcome. In all cases, long-term follow-up is recommended, especially in patients with chronic rhinosinusitis with nasal polyps.

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