# In-office balloon dilation and drainage of frontal sinus mucocele

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**ABSTRACT**

*Treatment of frontal sinus disease represents one of the most challenging aspects of endoscopic sinus surgery. Frontal sinus mucocele drainage may be an exception to the rule because in many instances, the expansion of the mucocele widens the frontal sinus recess and renders surgical drainage technically undemanding. Recently, there has been an increased interest in in-office procedures in otolaryngology because of patient satisfaction and substantial savings of time and cost for both patients and physicians. Similarly, the past few years have witnessed an increased use of balloon dilation devices in sinus surgery. Previously, we have described the in-office use of this device in treating patients who failed prior conventional frontal sinusotomy in the operating room. In this report, we describe our step-by-step in-office experience using this tool for drainage of a large frontal sinus mucocele.*

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Frontal sinus disease management has been a difficult undertaking in endoscopic sinus surgery. The challenges faced during frontal sinusotomy can be attributed to the difficult and narrow anatomy of the frontal sinus recess and significant mucosal trauma sustained during frontal sinusotomy. Hence, numerous new techniques and instrumentation have been developed to address the variety of frontal sinus pathologies.[1–6] Frontal sinus mucocele drainage may be an exception to the rule because the expansion of the mucocele significantly widens the frontal sinus recess and can render surgical drainage technically straightforward.

Recently, there has been an increased interest in in-office procedures in many subfields of otolaryngology.[7,8] Analyses of in-office procedures in laryngology, otology, and rhinology revealed them to be safe and satisfying for patients, with substantial savings of time and money for both patients and physicians.[8] In-office balloon dilation of the sinuses has recently gained significant popularity.[9] Although still controversial because of a lack of definitive substantiating evidence and prospective randomized control trials to support its efficacy,[10,11] proponents of this technology have reported favorable outcomes with its use.[9] To our knowledge, this device has not been described for the in-office drainage of large frontal sinus mucoceles. Previously, we have described the in-office use of balloon dilation in treating patients who failed prior conventional frontal sinusotomy in the operating room.[12] Given the many advantages of in-office procedures for patients and physicians, our familiarity with the balloon dilation device, and the relative straightforwardness of accessing a widened frontal sinus recess from mucocele expansion, we have used and are describing our step-by-step in-office experience using this tool to drain a large frontal sinus mucocele.

## ILLUSTRATIVE CASE

### Subject

A 68-year-old woman presented with a 2-year history of asymptomatic progressive right eye proptosis and pressure. She denied changes in visual acuity; diplopia; or history of sinusitis, anosmia, nasal congestion, or previous trauma. Oculoplastic examination revealed 4 mm of right proptosis, and 20/20 visual acuity. Nasal endoscopic examination revealed a deviated nasal septum to the left side and a widened right middle meatus and frontal sinus recess. The patient had a medical history significant for systemic hypertension, 38 pack-years of tobacco usage, pulmonary hypertension, and severe chronic obstructive pulmonary disease.

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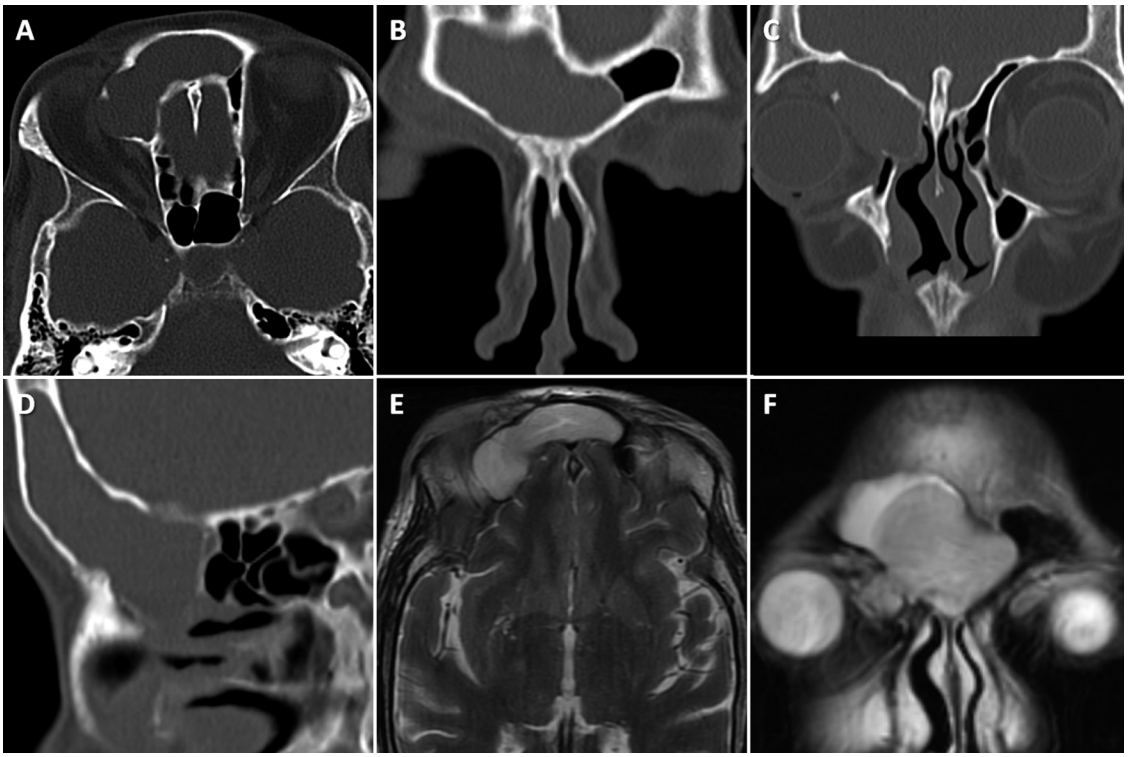


*Figure 1. (A) Axial, (B and C) coronal, and (D) sagittal computed tomography scans of the orbits and paranasal sinuses show an expansile right frontal sinus mucocele with downward and lateral compression and displacement of the globe. (E)Axial and (F) coronal T2-weighted magnetic resonance imaging show a hyperintense right frontal sinus mass consistent with a mucocele.*

**Radiological Evaluation**

Computed tomography scan of the orbits and paranasal sinuses showed a right frontal sinus expansile lesion with proptosis of the right eye with significant inferior and lateral displacement of the globe. There was erosion of the right lamina papyracea and the orbital roof (Fig. 1, *A–D*). Magnetic resonance imaging showed a large right frontal sinus mass with signal intensity consistent with a frontal sinus mucocele (Fig. 1, *E* and *F*).

**Surgical Technique**

Thirty minutes before the in-office rhinologic procedure, the patient was asked to take 2 tablets of oxycodone/acetaminophen (5/325 mg). The patient was then placed in the seated position and vital signs were assessed. The bilateral nasal cavities were decongested and anesthetized with a combination of oxymetazoline hydrochloride 0.05% and topical lidocaine hydrochloride 4%. After 5 minutes had elapsed, the right nasal cavity was packed with cottonoids soaked in topical lidocaine hydrochloride 4% and oxymetazoline hydrochloride 0.05% solution. Care was taken to lay the cottonoids in the middle meatus, anterosuperiorly in the region of the frontal sinus recess and against the nasal septum and anterolateral nasal wall to anesthetize the path of potential instrument contact. Ten minutes was subsequently allowed to elapse with the cottonoids in place against the nasal mucosa. Using a tuberculin syringe with a 25G needle, the areas surrounding the frontal sinus recess (upper uncinate process, upper middle turbinate, and anterior superior face of the bulla ethmoidalis) were injected with 1% lidocaine hydrochloride with 1:100,000 of epinephrine solution. After 5 minutes was allowed to elapse for an adequate anesthesia effect, the mucocele content was partially drained with a 21G needle. The frontal sinus recess area was subsequently cannulated using the transnasal balloon dilation probe (Entellus Medical, Inc., Maple Grove, MN) under direct endoscopic visualization with a 30 or 70° endoscope (Karl Storz and Co., Tuttlingen, Germany; Fig. 2). The content of the mucocele was collected for culture and pathological examination. The balloon was subsequently advanced, and the ostium was repeatedly dilated until an adequate diameter was achieved (≥5 mm).[13,14]

**Postoperative Care**

Postoperatively, the patient was treated with 10 days of an oral corticosteroid, a β-lactamase resistant penicillin, oxycodone/acetaminophen (5/325 mg) as needed for pain, and a topical nasal corticosteroid was started at the first postoperative visit (~7–10 days).

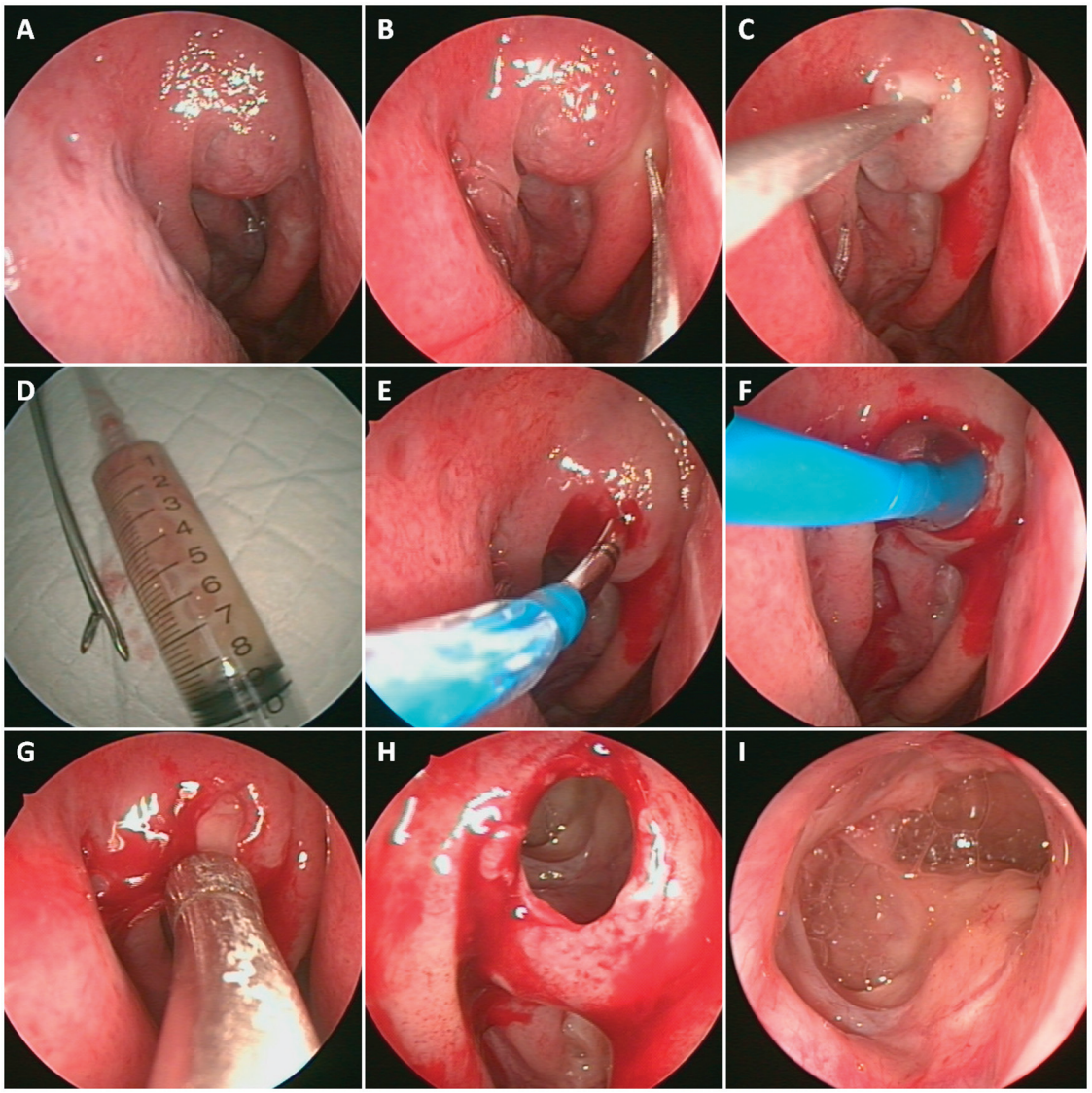


***Figure 2.*** *(A) In-office 30° endoscopic view shows expansion of the frontal sinus recess with bulging of the mucocele in the middle meatus. (B) After the nasal cavity was decongested and anesthetized, it was injected with 1% lidocaine with 1:100,000 of epinephrine solution. (C and D) The mucocele content was partially suctioned using a 10-mL syringe with a 21G needle. (E) The mucocele was then cannulated (F) with the balloon dilation probe and dilated. (G) The contents of the mucocele was subsequently evacuated, followed by repeated dilation using the balloon dilation device. Endoscopic (H) 30° and (I) 70° view of the opening and cavity after dilation.*

**Follow-Up**

Postoperatively, the patient's proptosis was significantly decreased. She maintained full extraocular movements and normal visual acuity with resolution of eye pressure. Her postoperative CT scan showed a widely patent right frontal sinus cavity (Fig. 3). She had a patent drainage pathway at her 8-month follow-up without signs of contraction.

## DISCUSSION

Frontal sinus disease is typically treated with medical management. Endoscopic sinus surgery is reserved for refractory cases and frontal sinus mucoceles or tumors. Postoperative recurrence secondary to scarring of the frontal sinus recess is not uncommon and is usually the result of mucosal trauma sustained during surgery, caused by significant manipulation of a narrowed frontal sinus recess. Typically, frontal sinus mucoceles have been treated using external or endoscopic techniques under general anesthesia. However, in many cases (as was seen in this case), this pathological entity does not represent a significant surgical challenge because of the expansion of the frontal sinus recess, which renders this usually difficult anatomic area straightforward to access.

The last 5 years have witnessed a significant increase in the number of in-office procedures performed by otolaryngologists because of patient's satisfaction, in-

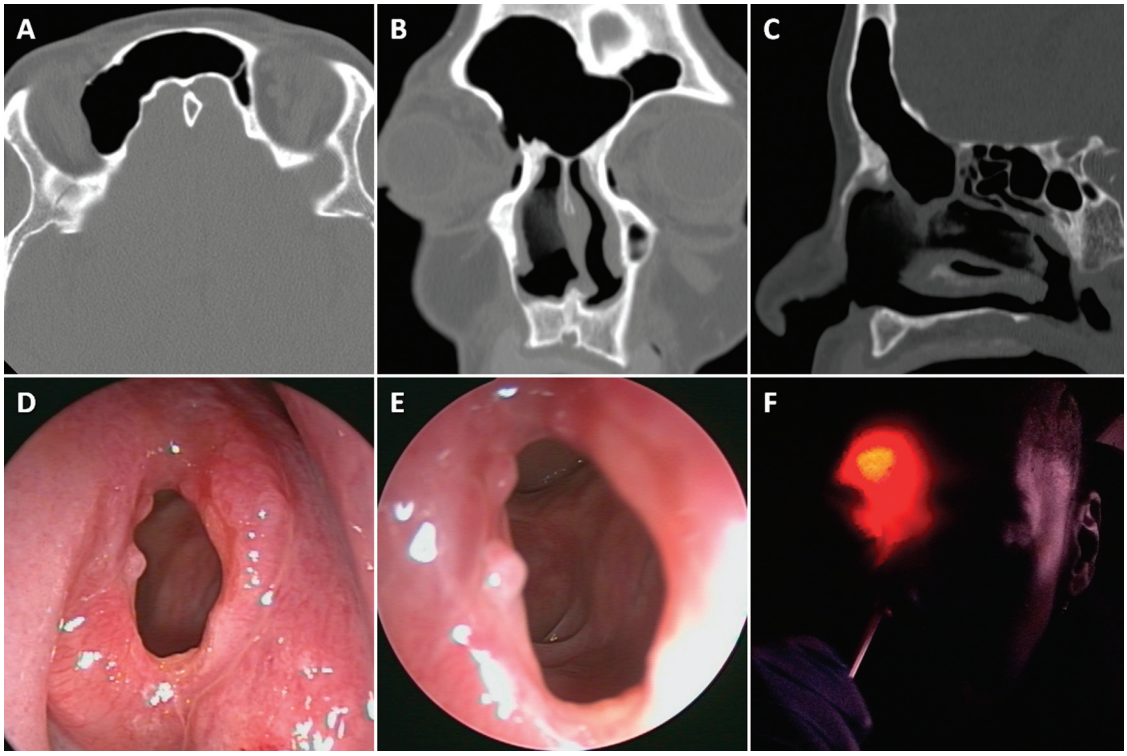


***Figure 3.*** *Postoperative (A) axial, (B) coronal, and (C) sagittal computed tomography scans of the orbits and paranasal sinuses show a patent right frontal sinus cavity. (D and E) Postoperative 70° nasal endoscopy shows a patent dilated opening. (F) Postoperative photograph of illuminated right frontal sinus cavity.*

creasing physician expertise, and significant savings in time and cost.[8] The subfield of rhinology, *e.g.*, has witnessed the emergence and escalating use of in-office balloon catheter devices as a means of dilating the diseased sinus ostia.[12] However, the use of balloon catheter devices has not been explicitly reported for drainage of large frontal sinus mucocele in the office. Potential advantages of the in-office use of this technology for drainage of frontal sinus mucoceles includes avoidance of the risks associated with general anesthesia, significantly shorter perioperative time for surgeons and patients alike, and overall decreased surgical cost.

To successfully use in-office balloon dilation for frontal sinus disease, appropriate patient selection is paramount. Although, ideally, one would prefer to operate on younger and healthier patients, this illustrative case shows a scenario where this technique was useful in an otherwise medically unhealthy patient. The expansion of this patient's frontal sinus recess from the mucocele definitely rendered surgical access feasible. This patient also had systemic and pulmonary hypertension, as well as chronic obstructive pulmonary disease, which significantly increased her risks of perioperative complications if she underwent general anesthesia.[15–17]

Clear understanding of frontal recess anatomy, familiarity with balloon catheter devices, and adequate patient selection make in-office balloon dilation and drainage of frontal sinus mucoceles an additional tool in the otolaryngologist's armamentarium for the management of frontal sinus mucoceles. This procedure should be considered a viable and reasonable option before subjecting patients to traditional endoscopic and open frontal sinus surgeries as well as the risks associated with general anesthesia. Nonetheless, it should be noted that this case could have been performed in the office setting using traditional endoscopic sinus surgery instruments. The balloon catheter device was chosen in this case because of the potential decrease in mucosal trauma associated with its use. Additionally, in cases of significant signal heterogeneity in a mucocele, multiple compartments within a mucocele, and significant and difficult bony architecture near the frontal sinus recess, this technique may not be the best approach. Traditional endoscopic sinus instruments may be superior in the aforementioned situations to completely address such mucoceles.

Given the loss of bone between the frontal sinus and orbital interface in the presented case, there are potential risks to introducing a balloon catheter into the frontal sinus mucocele without navigation. However, with adequate knowledge of the anatomy and appropriate surgical technique, this procedure can be achieved safely. Key steps to preventing complications in this setting include (a) meticulous and systematic analysis of preoperative imaging with special consid-

eration of areas of dehiscence at the skull base and lamina papyracea, (b) adequate patient selection (as for most in-office procedures, this case may not be appropriate for anxious patients), (c) adequate local anesthesia during the procedure, (d) suctioning of mucocele content to confirm the diagnosis before balloon dilation, (e) aiming of the balloon probe away from known dehiscent area, (f) ensuring correct positioning of the balloon catheter device within the mucocele through transillumination or fluoroscopy if available, and (g) care to only introduce a small portion of the probe and balloon into the mucocele.

Limitations of this study include all limitations inherent to a single case description. Although studies of this type are good in reporting novelty, a case study can not be used to make generalized recommendations. However, this novel technique should promote discussion and be the basis for future investigations in this area.

## CONCLUSION

In-office frontal sinus mucocele drainage using balloon dilation appears to be a feasible technique and potential alternative to conventional endoscopic procedures in the operating room. In properly selected patients (similar to the case described), this technique can obviate the need for general anesthesia and the operating room and potentially reduce surgical cost.

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