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# Unilateral transnasal endoscopic approach to frontal sinuses: Draf IIc

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## ABSTRACT

For chronic sinusitis surgery, the Draf III approach provides a common median drainage pathway for bilateral frontal sinuses from orbit to orbit. The Draf IIb provides unilateral drainage from orbit to septum. In several cases, inclusion of the nasal and frontal sinus septum in a Draf IIb was advantageous without extension to the opposite frontal recess. The proposed nomenclature is Draf IIc. This study was designed to (1) develop a surgical option for chronic frontal sinusitis where access to one frontal recess is limited or unnecessary and (2) minimize unnecessary surgical manipulation of uninvolved areas. Revision endoscopic frontal sinus surgery was performed on two patients with persistent frontal sinus opacification. Surgery crossed midline including one frontal recess with resection of the superior nasal septum. The surgical result was assessed on endoscopy and computed tomography (CT). The postoperative course was unremarkable with relief of frontal pressure. Postoperative CT scan showed well-aerated frontal sinuses with a widely patent common drainage pathway. Postoperative nasal endoscopy revealed normal mucosa with no exposed bone or edema. The Draf IIc extends the Draf IIb across the midline, without including the opposite frontal recess. This can be accomplished most easily using an interfrontal sinus septal cell or an eccentric interfrontal sinus septum. The Draf IIc is a surgical option in cases of chronic or recalcitrant frontal sinus diseases, including unilateral or bilateral obstruction, where access to the ipsilateral frontal recess is limited or favorable anatomy allows drainage with reduced manipulation of an uninvolved side.

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Frontal sinus disease continues to be one of the great challenges in rhinology with highly variable anatomy, difficult visualization, and a predilection to stenosis. The surgical options for frontal sinusitis range from a very limited opening of the anterior ethmoid to bilateral transseptal openings of the frontal sinus. Selection of the appropriate strategy is based on individual anatomy, pathophysiology of the targeted disease, and the goals of surgery.

For frontal sinus drainage, a classification system for endonasal frontal sinus surgery has been developed by Wolfgang Draf<sup>1</sup>: type I, simple drainage; type IIa and IIb, extended drainage; and type III, endonasal median drainage (Fig. 1, *a–d*). From type I to type III, frontal sinus drainage surgery is increasingly extensive. Typically, a more conservative, less-extensive approach is favored, because surgical manipulation in the frontal recess introduces the possibility of osteoneogenesis and frontal recess stenosis from surgical trauma.<sup>2</sup>

Opening a frontal sinus with an extended unilateral approach is limited by the septum and orbit, as in Draf IIb. There are situations when these limitations do not allow for sufficient width for an opening to remain patent; therefore, extension to the opposite side is appropriate.<sup>3,4</sup> A Draf III, which opens the frontal sinus floor from orbit to orbit, is the next option.<sup>5</sup> However, in selected cases, because of anatomic limitations, opening into the opposite frontal recess may not be possible or necessary. With this in mind, an extension of the Draf IIb technique can be used to open an obstructed frontal sinus across the midline but not extend to the opposite frontal recess. This technique, described as Draf IIc (Fig. 2), can be best applied in the setting of an interfrontal sinus septal cell or an eccentrically placed frontal sinus septum.

Two cases are described that illustrate the clinical indications and anatomy favorable for application of this technique. Approval by the Committee on Human Research of the University of California at San Francisco (San Francisco, CA) was obtained.

## PATIENT 1

L.V. is a 36-year-old white woman with a history of right chronic frontal sinusitis. She previously underwent two endoscopic sinus surgeries; however, she complained of daily frontal pressure and headache on the right side. The left side was never involved by symptom or radiography. Other rhinologic symptoms such as rhinorrhea and nasal obstruction were mini-

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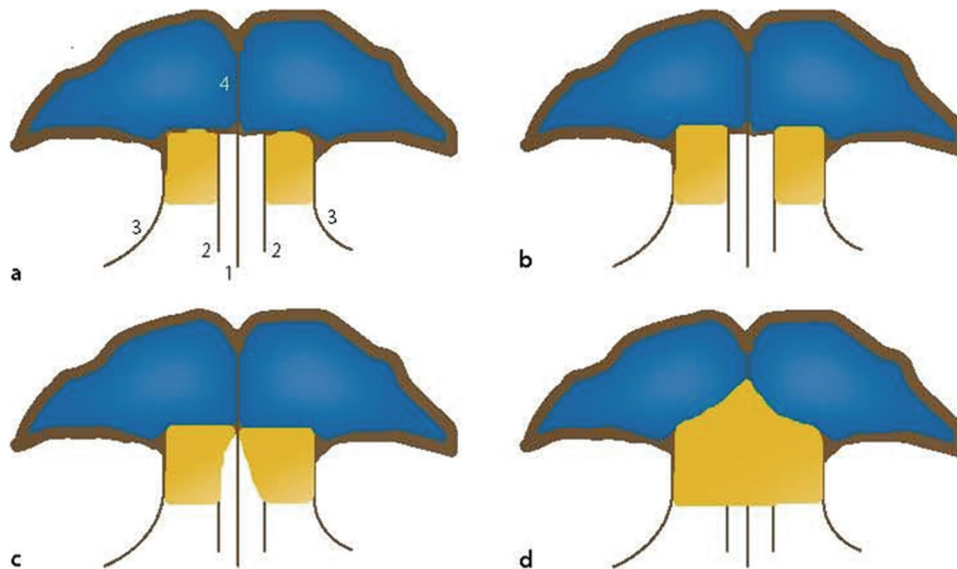
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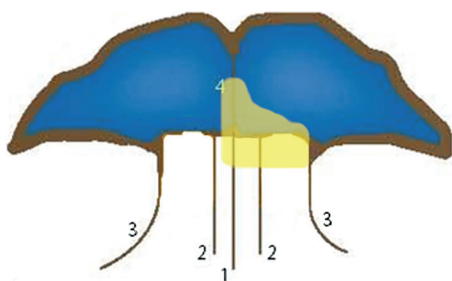
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**Figure 1.** Draf classification for frontal sinus drainage. 1, Nasal septum; 2, middle turbinate; 3, medial orbital wall; 4, interfrontal sinus septum (yellow area indicates the area to be resected). (a) Draf type I—simple drainage in which all cells within the confines of the frontal recess are removed. (b) Draf type IIa—extended drainage in which the frontal sinus floor is resected from the lamina papyracea to the middle turbinate. (c) Draf type IIb—extended drainage in which the frontal sinus floor is resected from the lamina papyracea to the nasal septum. (d) Draf type III—endonasal median drainage in which the frontal sinus floor is resected from the right lamina papyracea to the left lamina papyracea with additional resection of the upper nasal septum and the inferior part of the interfrontal sinus septum. (Source: Adapted with permission from Springer Science+Business. *The Frontal Sinus, In Rhinology and Facial Plastic Surgery*, Stucker FJ, de Souza C, Kenyon GS et al. [Eds], Berlin, Heidelberg, Germany: Springer-Verlag, p. 571, Fig. 52.3, a–d, 2009.)



**Figure 2.** Illustrative representation of Draf IIc. 1, Nasal septum; 2, middle turbinate; 3, medial orbital wall; 4, interfrontal sinus septum (yellow area indicates the area to be resected).

mal. Nasal endoscopy revealed residual right anterior ethmoid cells and a narrowed right frontal sinus outflow tract. Medical management had not been successful in aerating the opacified right frontal sinus and alleviating her symptoms. A revision right frontal sinusotomy was planned using an extended unilateral endoscopic approach to widen the narrow right frontal recess and minimize manipulation of the left side.

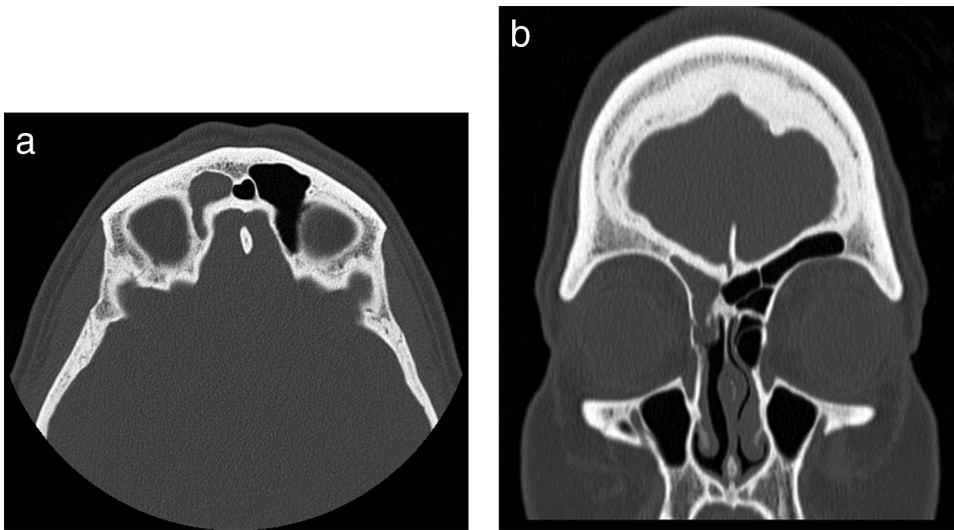
### Computed Tomography Findings

Computed tomography (CT) scan of the sinuses showed persistent opacification of the right frontal sinus, residual right anterior ethmoidal and agger nasi cells, and a new bone formation (osteoneogenesis) obstructing the frontal sinus drainage pathway. Importantly,

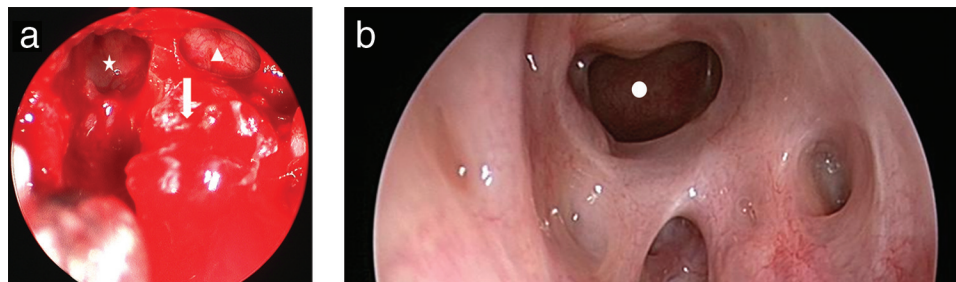
an aerated interfrontal sinus septal cell superior to the nasal septum was present. On the left side, the sinuses were well aerated and free of disease (Fig. 3, a and b).

### Surgical Technique

Under general anesthesia and image guidance, the residual right anterior ethmoidal cells, agger nasi cells, and septations were removed. The right frontal recess remained narrow with new bone formation and significant mucosal edema. The decision was made to perform an extended endoscopic Draf IIb procedure across the midline (Draf IIc) to further widen the narrow right frontal recess in a medial–lateral dimension. The septal mucosa was incised and elevated from the bony septum and subsequently removed. The exposed superior bony septum was removed up to the frontal sinus floor. Using a combination of a 30° endoscope and a 4-mm 70° reverse taper diamond drill, the thick bone medial to the right frontal recess was drilled out moving anteromedially across the midline to the left side. Care was taken to avoid trauma to the mucosa of the interfrontal sinus septal cell and violation of the cribriform plate. The large common drainage pathway was then created between the right frontal sinus and the interfrontal sinus septal cell (Fig. 4 a). Further septations were taken down with an angled articulated Kerrison to ensure adequate opening. Stammberger



**Figure 3.** Preoperative computed tomography (CT) scans for patient 1. Axial (a) and coronal (b) views, bone window, showing opacified right frontal sinus, and clear left frontal sinus with clear interfrontal sinus septal cell in between.



**Figure 4.** Intraoperative and postoperative endoscopic views for patient 1. (a) The endoscopic view shows the right frontal sinus (star), the interfrontal sinus septal cell (triangle), and the superior bony nasal septum (arrow). Note the created large common drainage pathway. (b) Six-month postoperative nasal endoscopic view. Note, the large common drainage pathway (circle).

sinu-foam (ArthroCareENT Corp., Austin, TX) was applied to the common cavity and MeroGel (Medtronic ENT, Inc., Jacksonville, FL) was placed within the ethmoid cavity and infused with 2 mL of triamcinolone at 40 mg/mL.

#### Postoperative Period

The postoperative course included follow-up at 2 and 6 weeks for examination and debridement. She noticed improvement in pressure and headache, which were improved by the first postoperative visit. By 6 months postoperatively, CT scan showed well-aerated frontal sinuses with a widely patent common drainage pathway. Nasal endoscopy revealed normal mucosa with no exposed bone or edema with symptom resolution (Fig. 4 b).

#### PATIENT 2

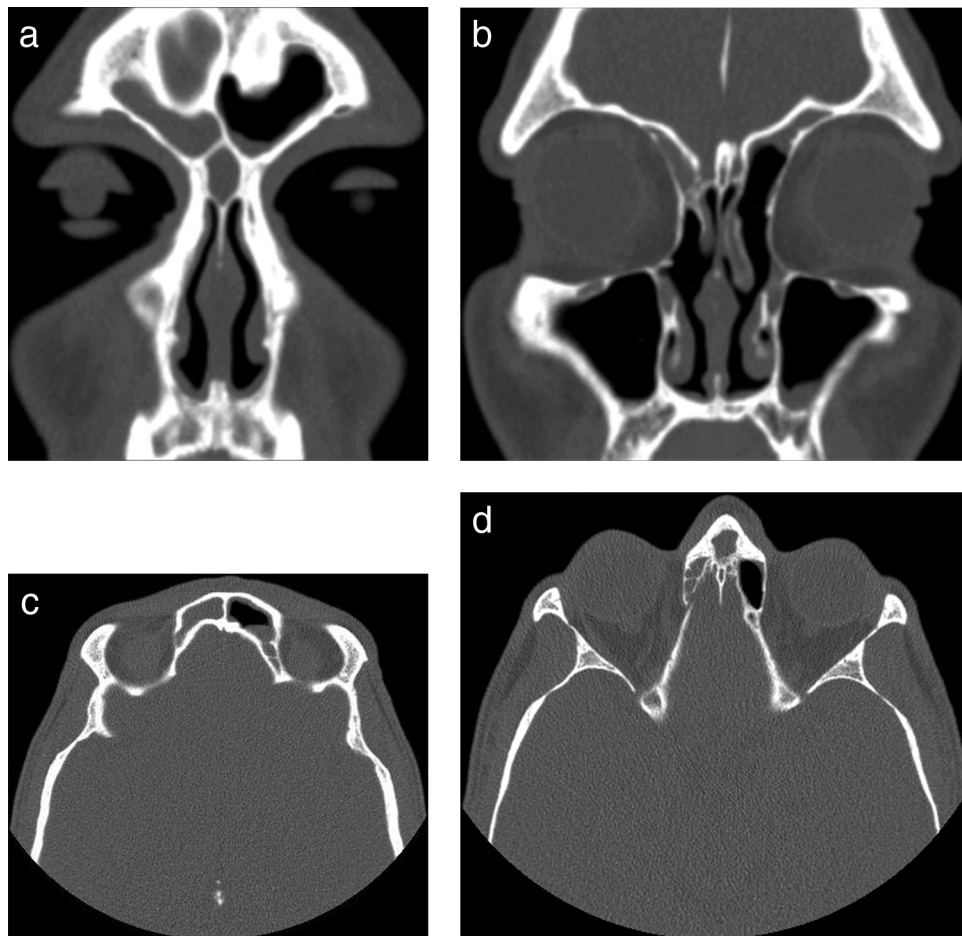
J.C. is a 37-year-old white man with a history of chronic sinusitis who failed to respond to conservative medical treatment and has undergone two prior endoscopic sinus surgeries. Subsequent aggressive medical therapy over the course of a year failed to resolve recurrent frontal sinusitis with pressure and frontal

headache. Nasal endoscopy revealed an obstructed edematous right frontal recess with no discernible opening and a lateralized middle turbinate. The left frontal recess was patent but narrowed with mucosal edema. Other sinuses were unremarkable. Because of the CT findings described in the next section with an obstructed right frontal recess, the scarred lateralized right middle turbinate and the low-lying asymmetrical skull base, the decision was made to proceed with Draf IIc from the left side.

#### CT Findings

CT scan of the sinuses showed an opacified right frontal sinus with obstructed outflow tract and the left frontal sinus showed mucosal thickening only with patency in its outflow tract. An opacified interfrontal sinus septal cell was observed with a low-lying asymmetrical skull base and a lateralized middle turbinate on the right side with osteoneogenesis. There was insufficient space to perform a right frontal sinusotomy between the skull base and orbit (Fig. 5, a-d). He was offered and elected to undergo a revision endoscopic frontal sinus surgery with a modified unilateral approach to drain the right frontal sinus from the left side



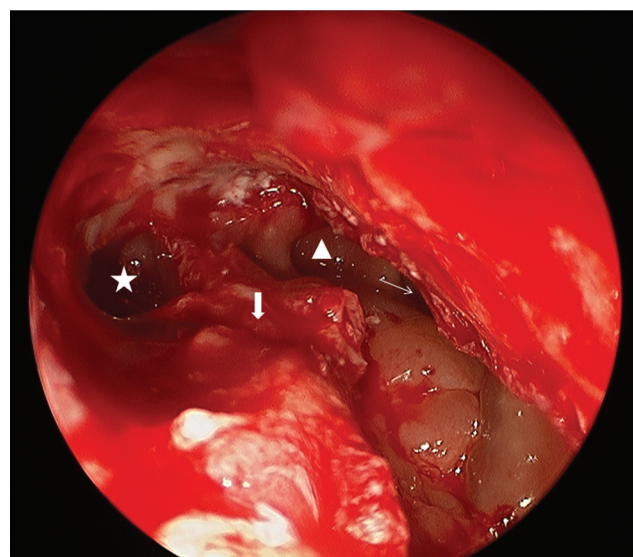


**Figure 5.** Preoperative computed tomography (CT) scans for patient 2. (a) Coronal view, bone window, showing opacified interfrontal sinus septal cell, and right frontal sinus. Note, the interfrontal sinus septum is intact. (b) Coronal view, bone window, showing lateralized right middle turbinate, and low-lying asymmetrical skull base. Insufficient room between the middle turbinate and orbit necessitates an alternate approach. (c) Axial view, bone window, showing right opacified frontal sinus, intact interfrontal sinus septum, and mucosal thickening of left frontal sinus. (d) Axial view, bone window, showing opacified interfrontal sinus septal cell, and right frontal recess.

through the frontal recess and the interfrontal sinus septal cell.

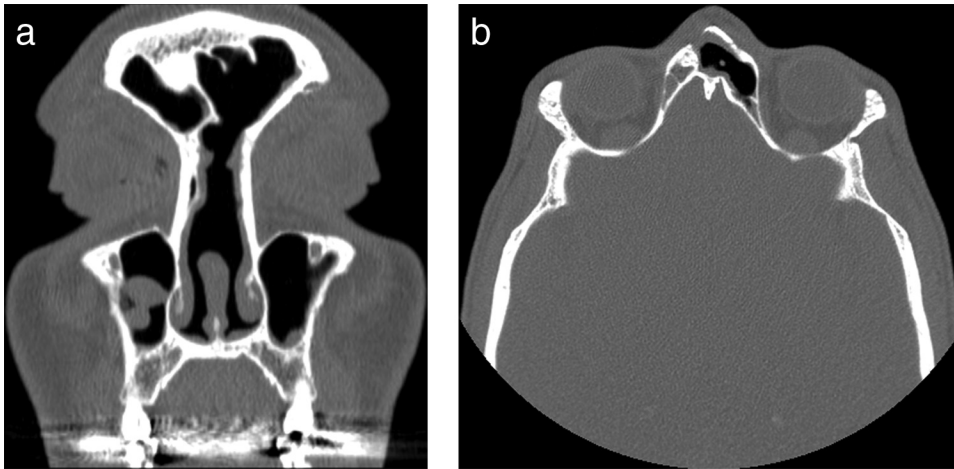
### Surgical Technique

Under general anesthesia and image guidance, the middle turbinate was medialized to improve patency of the left frontal recess and create a common drainage pathway for both frontal sinuses from the left side. The left middle turbinate was excised up to its root. With an angled beaver blade, the septum was incised. Remnant septal cartilage and bone were taken down along with the right mucosal flap superiorly, working toward the interfrontal sinus septal cell. This cell was opened after drilling out the thickened bone around its anterior–inferior aspect using a combination of a 30° endoscope and a 4-mm curved drill. Once the interfrontal sinus septal cell was opened, it was brought into continuity with the left frontal recess, taking down the thick intervening bone. The right frontal sinus was then approached and thick mucoid discharge was drained through the interfrontal sinus septal cell. The large common drainage pathway was created and further septations were taken down with an angled articulated Kerrison to ensure adequate opening (Fig. 6). To prevent anterior–posterior scarring in the frontal re-

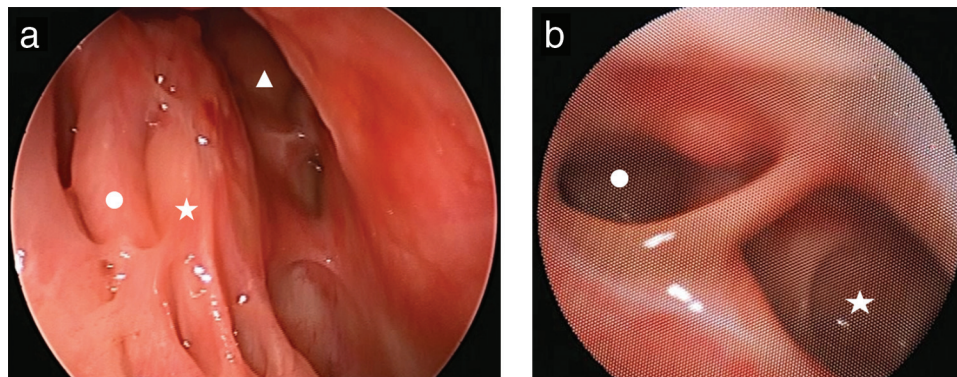


**Figure 6.** Intraoperative nasal endoscopic view for patient 2. Intraoperative nasal endoscopic view showing the right frontal sinus (star), the interfrontal sinus septal cell (triangle), the left frontal sinus opening (narrow arrow), and the superior nasal bony septum (wide arrow).

cess, a silastic sheet of 0.51 mm in thickness was fashioned into a T with the short arms placed into the left and right frontal sinuses and the long arm extending



**Figure 7.** Postoperative computed tomography (CT) scans for patient 2. Coronal (a) and axial (b) views, bone window, showing a common drainage pathway between the left frontal sinus, and interfrontal sinus septal cell.



**Figure 8.** Postoperative nasal endoscopic views for patient 2. (a) A 4-month postoperative left nasal endoscopic view showing the right middle turbinate (dot) and septum (star). The common drainage pathway begins with the left frontal sinus (triangle) and extends anteriorly to the interfrontal sinus septal cell and right frontal sinus in Fig. 8 b. (b). A 4-month postoperative nasal endoscopy view showing a large common drainage pathway between the right frontal sinus (dot) and the interfrontal sinus septal cell (star).

inferiorly for later in-office retrieval. Stammberger sinu-foam infused with 8 mL of triamcinolone at 40 mg/mL was placed in the defect.

### Postoperative Period

The silastic sheet was removed at 4 weeks. Most of his frontal pressure and headache were resolved by the first postoperative visit. By 4 months postoperatively, CT scan showed well-aerated frontal sinuses with a widely patent common drainage pathway (Fig. 7, a and b). Nasal endoscopy revealed normal mucosa with no exposed bone or edema with symptom resolution (Fig. 8, a and b).

### DISCUSSION

The choice of approach to widen the frontal recess ranges from unilateral opening of the frontal sinus with uncinectomy to wide bilateral drainage from orbit to orbit. The Draf classification system provides a systematic graduated framework for this surgery.

In unusual circumstances, ipsilateral endoscopic frontal sinus drainage is prohibitive. Causes of endo-

scopic inaccessibility of the frontal recess include narrow anteroposterior and mediolateral dimensions of frontal recess, severe scarring and synechiae, new bone formation, and impingement by the anterior cranial fossa.<sup>6-8</sup> Anatomic factors that facilitate the approach described here include an interfrontal sinus septal cell or eccentric interfrontal sinus septum. Van Alyea noted interfrontal sinus septal cell in 28 (11.6%) of his 242 dissection specimens.<sup>9</sup> In these cases, before moving forward with a more aggressive procedure (Draf III or frontal osteoplastic flap), consideration should be given to a less extensive approach, a Draf IIc, to avoid the more invasive procedures and minimize surgical manipulation of the noninvolved side. Furthermore, Anderson and Sindwani reported an overall failure rate (requiring further surgery) of Draf III procedure of 13.9% in their study.<sup>10</sup>

### CONCLUSION

Two cases were presented in which a modification of the Draf IIb approach for frontal sinusotomy termed a Draf IIc was successfully used. The Draf IIc provided a

method for opening a frontal sinus, extending the Draf IIb across the midline, although not including one frontal recess. This can be accomplished most easily using an interfrontal sinus septal cell or an eccentric interfrontal sinus septum. The Draf IIc is an important surgical option in cases of chronic or recalcitrant frontal sinus diseases, including unilateral and bilateral obstruction, where access to the ipsilateral frontal recess is limited or favorable anatomy allows drainage with reduced manipulation of an uninvolved side.

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