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INTRODUCTION

The frontal sinus is considered the most difficult sinus to access surgically due to its variable anatomy and challenging position.1–3 Because endoscopic surgical skills and tools have advanced, both interest in frontal sinus surgical approaches and frequency of frontal sinus surgery have blossomed.4–6 Devised by the innovative sinus surgeon Wolfgang Draf, the Draf classification system is the most commonly utilized construct to organize advanced surgical approaches to the frontal sinus (Table 1).4–6 Additional expanded and adjunct techniques have been described to access the frontal sinus, which largely center on tumor access in difficult lateral anatomic locations or refractory chronic rhinosinusitis (CRS) short of the Draf III procedure.7–12 Realistically, however, when confronted with refractory frontal sinusitis, many otolaryngologists around the world do not have access to the endoscopic-powered drills or image guidance. Moreover, few have the experience and confidence necessary to carry out a Draf III procedure or complete the debridements required for optimal Draf III patency.

We here describe a hybrid procedure that incorporates facets of two classic Draf-based approaches (Draf IIb and Draf III), which have proven instrumental for selected refractory frontal sinus patients in our practice. This crosscourt Draf IIb (CCDIIb) approach combines the widened frontal ostium (from orbit to septum) of the Draf IIb with the anterosuperior nasal septectomy of the Draf III. This allows crosscourt contralateral endonasal frontal sinus access, with reduced frontal obstruction from septal mucosal disease, without the need for drilling of the bony nasal beak, anterior table, or frontal intersinus septum (Fig. 1), and thus can be completed using hand instruments alone. We have found the CCDIIb approach to have utility in numerous settings, and here discuss its varied indications to date through five case examples.

MATERIALS AND METHODS

Five patients with chronic frontal sinusitis treated with the CCDIIb technique were retrospectively reviewed. All met diagnostic criteria for CRS with nasal polyposis (CRSwNP) and had undergone previous surgery, including bilateral Draf IIa frontal sinusotomies. All patients had radiographic and clinical evidence of frontal sinus inflammation.

Patient 1 had profound refractory frontal polyposis extending into the olfactory cleft and high nasal septum medial to the middle turbinate (MT). Patient 2 also had obstructive polyposis involving the high nasal septum, as well as a limited anterosuperior posterior diameter, with dense interfrontal septal bone between bilateral hypoplastic, opacified frontal sinuses (Fig. 2). Patient 3 similarly had nasal polyposis arising from the nasal septum medial to the MT (Fig. 3), as well as osteitic nasofrontal beak with narrow anterosuperior diameter. Patient 4 demonstrated refractory CRSwNP in the setting of a persistent fонтicus frontalis of the intersinus frontal septum, obviating Draf III consideration (Fig. 4). Patient 5 had nasal obstruction with dense tissue arising from the nasal septum in the setting of recurrent CRSwNP (Supporting Fig. S1). Patients 1 and 5 were ultimately diagnosed with foci of high nasal septal respiratory epithelial adenomatoid hamartoma in the background of refractory CRSwNP.

Surgical Technique

The endoscopic CCDIIb (bilateral Draf IIb frontal sinusotomies with anterosuperior nasal septectomy) begins with resection of the anterior portion of the bilateral MT toward the cribiform attachment, followed by bilateral Draf IIb frontal sinusotomies, as previously described.4,5,13 This effectively removes the frontal sinus floor from orbit to nasal septum. The diseased anterosuperior nasal septum is then resected, starting with a freer elevator at the level of the axilla and then creating a 1.5 × 1.5 cm anterior septal window using through-cutting instrumentation and microdebrider (if available). Crosscourt access (left-to-right and vice versa) through the Draf IIb frontal sinusotomy allows access to the anterosuperior and inferonasal portions of the frontal sinus.
sinusotomies is then available to remove all active CRS/neoplastic disease using hand instruments. Great care is taken during the anterior MT resection and nasal septectomy to prevent inadvertent injury to the anterior cribriform or lateral lamella. A post-operative endoscopic image of a CCIIb surgical result is shown in Figure 5. In some patients, the anterosuperior septectomy is required up-front due to difficulty visualizing the axilla and frontal recess from hyperplastic septal disease, with Draf IIb procedures performed afterward (e.g., patient 2). No patients had frontal sinus stents placed at the time of surgery. All patients had bilateral placement of Nasopore polyurethane polymer sponges (Stryker Corp., Kalamazoo, Michigan, U.S.A.) in the middle meatus at the frontoethmoid junction to prevent postoperative bleeding and to maintain the position of remnant middle turbinates. Postoperatively, patients have required two endoscopic debridements in the first month and are maintained on saline plus budesonide irrigations over 3 months.

**RESULTS**

Potential indications for the CCDIIb are listed in Table II.

All patients underwent the CCDIIb with > 6-month follow-up (range 7–10 months), without any complications such as epistaxis, orbital injury, cerebrospinal fluid leak, saddle nose deformity, or septal hematoma. All patients experienced minimal postoperative crusting, marked improvement in symptoms, and maintained frontal sinus and septal window patency. To date, no patient has developed postoperative sequelae, such as restenosis of the frontal ostium or septectomy, or has required revision.

**DISCUSSION**

The Draf classification is a well-established progressive ladder of endoscopic surgical techniques to address increasingly advanced frontal pathology. With improved endoscopic technology and increasingly complex frontal sinus pathology being addressed endoscopically, variations of the traditional Draf classification have also emerged.

Eloy et al. have described several unique variations of the Draf system, such as the mini-modified Lothrop procedure for patients with frontal disease, which is inaccessible from the ipsilateral route due to orbital fracture with fat prolapse and so forth. This technique involves removal of the frontal intersinus septum to allow drainage of the diseased sinus through the contralateral Draf IIb opening. This case series of four patients reported no major complications, with symptom resolution in all patients at last follow-up (range 9–28 months).

Komser and Goldberg have also described a similar extended Draf IIb approach, which they have termed the Draf IIc. This includes an ipsilateral Draf IIb, with removal of the frontal intersinus septation in cases for which a frontal intersinus cell is present to allow a common unilateral frontal drainage pathway. The authors

<table>
<thead>
<tr>
<th>Draf Procedure</th>
<th>Surgical Approach</th>
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<tbody>
<tr>
<td>Draf I</td>
<td>Complete ethmoidectomy in region of frontal recess</td>
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<tr>
<td>Draf IIa</td>
<td>Removal of frontal sinus floor between lamina papyracea and middle turbinate</td>
</tr>
<tr>
<td>Draf IIb</td>
<td>Removal of frontal sinus floor between lamina papyracea and septum</td>
</tr>
<tr>
<td>Draf III</td>
<td>Removal of entire frontal sinus floor from orbit to orbit, including removal of anterosuperior portion of nasal septum, nasofrontal beak, and frontal intersinus septum</td>
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</tbody>
</table>

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**TABLE I. Classification of Frontal Sinus Procedures Devised by Wolfgang Draf.**

![Fig. 1. Illustrations depicting optimal endoscopic results following advanced frontal sinus dissection. (A) Traditional Draf IIb (right-sided), (B) classic Draf III procedures, and (C) crosscourt Draf IIb. (star: partially trimmed root of middle turbinate; triangle: intact (A) or resected nasal septum (B, C); arrows: anterior rim of cribriform plate.)

![Fig. 2. (A) Computed tomography scan axial cut demonstrating narrow anteroposterior diameter of hypoplastic frontal sinuses with dense central intersinus septum bone, and (B) coronal cut demonstrating obstructive polypoid disease of the superior nasal septum (white arrows) that both limits surgical access to, and postoperative patency of, the frontal sinuses.](image-url)
recommend this technique when unilateral frontal disease is present to avoid manipulation of the uninvolved frontal recess. In their series of two patients, symptom resolution is also reported with no major complications. A similar modification by Eviatar et al. describes an identical unilateral Draf IIb technique, along with the creation of a small septal window, without addressing the contralateral frontal sinus.\textsuperscript{12}

Beyond the Draf IIb, the Draf III procedure is currently the most advanced endoscopic technique to maintain frontal sinus patency and drainage. It involves complete drill-out and removal of the bilateral frontal sinus floors, nasofrontal beak, and intersinus septum to create an expansive, single frontal sinus cavity. This technique also involves the creation of a $2 \times 2$ cm septectomy in the neighboring portion of the nasal septum for crosscourt, bilateral access.\textsuperscript{4} This approach is typically reserved for severe refractory disease but can lead to early post-operative morbidity due to the breadth of surgically exposed bone, crusting, early synchiae formation, and protracted healing times. Although recent data

<table>
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<tr>
<th>Crosscourt Draf IIb*</th>
<th>Current Indications</th>
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<tr>
<td>Removal of frontal sinus floor from lamina papyracea to septum (bilateral Draf IIb), including removal of anterosuperior portion of nasal septum (portion of Draf III)</td>
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<tr>
<td>1. Refractory inflammation and polypoid change of anterosuperior nasal septum leading to frontal recess obstruction</td>
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<tr>
<td>2. Refractory frontal CRSwNP involving middle turbinates and nasal septum with excessively narrow anteroposterior diameter between frontal sinuses</td>
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<td>3. Refractory frontal CRSwNP with persistent fonticulus frontalis</td>
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<td>4. Neoplastic disease arising from anterosuperior nasal septum (e.g. REAH with septal erosion, other tumors)</td>
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</table>

*Proposed hybrid procedure detailed in this article.

CRSwNP = chronic rhinosinusitis with nasal polyposis.
has suggested fewer complications and reduced morbidity in experienced hands,\textsuperscript{12,14,15} many otolaryngologists do not possess the experience, or have access to the equipment and navigation required, to confidently carry out a Draf III procedure.

The CCDIIb technique offers a novel, advantageous, hybrid technique that integrates widened frontal ostia (taken from the bilateral Draf IIb), along with the cross-court anterior skull-base exposure via septectomy (taken from the Draf III). This technique expands the endoscopic armamentarium and options available to surgeons confronted with refractory frontal sinusitis, without the need for powered instruments, and provides bilateral frontal access and patency from orbit to septum while allowing removal of dense, obstructive tissue involving the anterosuperior nasal septum. Moreover, we observed no disadvantage in maintaining the bony nasal beak and interfrontal septum in these selected patients, which has greatly reduced the duration of surgery as well as post-surgical wound healing given the reduced bone exposure as compared to Draf III frontal sinusotomy. Also, for some revision surgical candidates, the risks of creating a Draf III common frontal cavity (see patients 2 and 4) were also avoided by selecting the CCDIIb approach.

CONCLUSION

The CCDIIb is a hybrid surgical procedure that utilizes elements of the classic Draf IIb and Draf III approaches to both widen the frontal sinus outflow tracts and address obstructive midline inflammatory and neoplastic disease situated at the superior nasal septum. This technique has proven to be especially useful in cases of CRSwNP and excessive nasal septal thickening. It provides many of the advantages of a Draf III approach in selected cases, without excessive bone exposure. This procedure provides an avenue for improved frontal access during sinus surgery, reduced inflammatory tissue burden in the region of the frontal sinus and anterior skull base, and optimized in-office surveillance of the frontal sinuses. The CCDIIb can be used by otolaryngologists with limited available equipment who seek increased alternatives for addressing refractory frontal sinus and advanced septal pathology.

BIBLIOGRAPHY