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Endoscopic Frontal Sinusotomy—Preventing Recurrence or a Route to Revision?

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Objectives/Hypothesis: The Messerklinger technique is an endoscopic approach to sinus surgery designed to be minimally invasive and preserve mucosa and therefore physiological function. More recently there have been advocates for more radical endoscopic approaches to the frontal sinus such as the modified Lothrop procedure. This study aims to determine the effectiveness of endoscopic frontal sinusotomy in preventing recurrent frontal sinus disease and the need for any revision frontal sinus surgery.

Study Design: Retrospective data review.

Methods: A retrospective review of the chronic rhinosinusitis database at St. Paul's Sinus Centre was performed, randomly selecting 200 patients who had undergone primary bilateral functional endoscopic sinus surgery between 2000 and 2009. Any endoscopic or radiological recurrences listed on the database were counted along with the number of cases returned to theater for revision surgery. The preoperative Lund-Mackay score was also extracted from the database.

Results: In the 200 patients who had undergone their primary surgery at St. Paul's Hospital, the recurrence rate of frontal sinus disease was 19%, with less than one half (8%) requiring revision surgery. The Lund-Mackay scores showed no correlation between disease severity and the incidence of recurrence ($P = .35$), and there was no difference between polyp and nonpolyp forms of chronic rhinosinusitis ($P = .14$). A comparison with 100 patients in the database who had received their primary surgery at another center showed that the revision patients had a recurrence rate of 34% and a revision rate of 21%. The patients who did not receive surgical revision were treated satisfactorily with topical medications in the outpatient clinic.

Conclusions: Meticulously performed endoscopic frontal sinusotomy with computer guidance appears to be an effective minimally invasive procedure to treat chronic frontal sinusitis secondary to outflow tract obstruction. Properly performed, it is effective in dealing with the most diseased frontal sinus. It offers clear advantages in reducing complications and recurrence rates in frontal sinus disease even in revision cases.

Key Words: Endoscopic frontal sinusotomy, frontal sinusitis, recurrence, surgical revision.

Level of Evidence: 2c.

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INTRODUCTION

Accessing the frontal sinus provides a greater challenge surgically, owing to the anatomical constraints present in an endoscopic approach, compared to the other sinuses. Nonetheless, the endoscope has revolutionized what was historically undertaken by open procedures such as the osteoplastic flap.[1] Any surgeon approaching the frontal sinus endoscopically must have sufficient experience in navigating the frontal recess and sinus, with its variable array of cells from the agger nasi to the intersinus septal and frontal cells, and will need suitable instrumentation to achieve excellence in this procedure. Messerklinger developed the endoscopic technique with the aim of relieving diseased sinuses while preserving mucosa and at the same time being minimally invasive.[2] Although the technique has previously been championed,[3] other endoscopic techniques have gained recent vogue, namely the modified Lothrop[4,5] (frontal sinus drill out) and balloon sinuplasty.[6–8] Combined and open approaches to the frontal sinus are also available options, such as trephination[9,10] and osteoplastic flaps with or without obliteration.[11–13] The key aim of treating the frontal sinus is not only the relief of existing disease but also prevention of subsequent recurrent disease. This is always inherently easier to achieve when the primary surgical intervention is conducted with this key aim in mind. Unfortunately, iatrogenic

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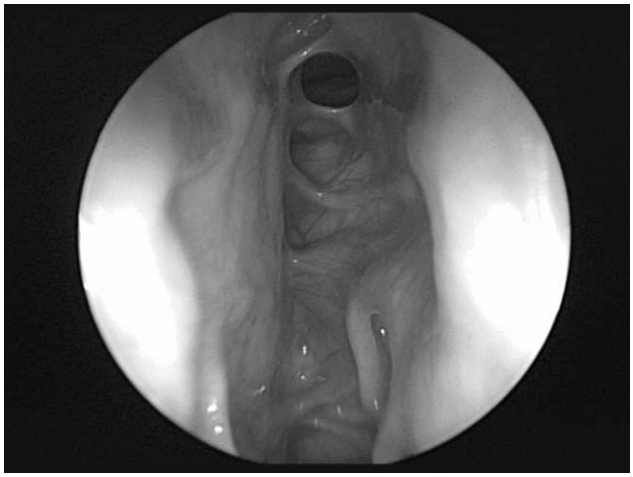

Fig. 1. Healed frontal recess and ostium.

causes have a large part to play in recurrent frontal sinusitis, but osteoneogenesis and recurrent polyposis are also significant factors.

The aim of this study was to look principally at our practice of endoscopic frontal sinusotomy with respect to recurrence of frontal sinusitis and the need for revision surgery, and to see if the radiological severity of the preoperative computed tomography (CT) scan had any correlation with the incidence of recurrence.

MATERIALS AND METHODS

At the St. Paul's Sinus Centre (SPSC) a database of patients with chronic rhinosinusitis (CRS), as defined by the American Academy of Otolaryngology–Head and Neck Surgery guidelines, has been established with cases entered dating back to 2000. Local institutional review board approval has been sought for the database. Two hundred patients who had undergone bilateral functional endoscopic sinus surgery (FESS) between 2000 and 2008 were randomly selected from the database for inclusion in the study. Specific information sought from the database included: 1) any documented recurrent frontal sinusitis either by endoscopic visualization of pus, polyps, or stenosis or by opacification on computed tomography following the FESS; 2) any revision frontal sinusotomy required within 12 months of the FESS; and 3) the preoperative Lund-Mackay scores. All of the patients included had their primary surgery performed at St. Paul's Sinus Centre. Numbers of recurrences and revisions were collated and analyzed in conjunction with the preoperative Lund-Mackay scores using an unpaired *t* test. Patients were also classified as CRS with polyps or CRS without polyps (no patients with allergic fungal rhinosinusitis were included). In order to compare the data against patients who had their primary surgery performed elsewhere, 100 patients who had received their primary sinus surgery at another center were randomly extracted from the database, and the same information was derived. These patients all underwent a second (revision) procedure at SPSC and therefore any recurrences or revisions in this group were second recurrences or revisions.

The operative approach utilized in our center for frontal sinusotomy is along the lines of the Messerklinger technique—minimally invasive and with meticulous preservation of mucosa. For this purpose the instruments at our disposal include 70° and 90° Karl Storz reverse post endoscopes (Karl Storz, Tuttlingen, Germany), a variety of refined instruments including Karl Storz Heuweiser/Kuhn frontal forceps (45° and 90°), frontal sinus seekers, frontal sinus giraffe forceps (45° and 90°), and angled suction curettes and mushroom punches. Alongside these the GE InstaTrak 3500+ (GE Healthcare, Waukesha, WI) image guidance software is employed for all cases of frontal sinusotomy to ensure that any frontal recess cells such as Kuhn type 1-3 cells, supraorbital ethmoid cells, and intersinus septal cells are cleared to allow adequate drainage of the frontal sinus (Fig. 1).

TABLE I.
Summary Statistics.

Sex	Male = 102	Female = 102
Age range, yr	17–82	Mean = 51
Polyps	Yes = 86	No = 113

TABLE II.
Summary Findings of Study—Primary Cases (n = 204) and Revision Cases (n = 98).

	Primary (%)	Revision (%)
Recurrence rate	19	34
Revision rate	8	21
Conversion rate	45	64

RESULTS

There was an equal number of male and female patients, with an age range from 17 to 82 years and polyps present in 86 cases (six unknown) (Table I). The results of the study are summarized in Table II, relationship to polyps in Table III, and detailed results are present in Table IV. We found that the overall recurrence rates for frontal sinusitis was 19% in the group of patients who underwent their primary surgery at SPSC and 34% in those who underwent their primary surgery elsewhere. In terms of the number of patients who underwent revision surgery for the frontal sinus, only 8% in the primary group required a return to theater compared to 21% in the revision group. This equates to a surgical conversion rate (i.e., rate of recurrences that

TABLE III.
Relationship of Polyps to Recurrences and Revisions.

	Recurrences	No Recurrences
Polyps	20	66
No polyps	17	96
P value		.14

	Revisions	No Revisions
Polyps	7	79
No polyps	11	101
P value		.683

TABLE IV.
Detailed Findings of Study Broken Down Chronologically.

	Primary Surgery at SPH				Revision Surgery at SPH			
Year	Total Cases	Recurrences	Revisions	Conversion Rate (%)	Total Cases	Recurrences	Revisions	Conversion Rate (%)
2000	3	1	1	100	2	2	2	100
2001	10	2	1	50	10	5	4	80
2002	20	7	6	86	4	1	1	100
2003	15	4	3	75	9	6	5	83
2004	15	4	2	50	9	6	4	67
2005	20	1	0	0	9	3	1	33
2006	25	8	0	0	15	5	2	40
2007	19	1	0	0	13	2	1	50
2008	51	8	4	50	18	3	1	33
2009	26	2	0	0	9	0	0	0
2000–2004	63	18	13	72	34	20	16	80
2005–2009	141	20	4	20	64	13	5	38
Overall	204	38	17	45	98	33	21	64

SPH = St. Paul's Hospital.

were returned to the operating theatre) of 45% in the primary group and 64% in the revision group. When broken down chronologically, as seen in Table II, the recurrence rate and revision rate for both the primary and secondary groups has improved considerably, from 29% and 59% recurrence and 21% and 47% revisions in 2000to 2004 to 14% and 20% recurrence and 3% and 8% revisions for primary and secondary respectively in 2005 to 2009. The conversion rates to revision surgery for these recurrences are considerably better in primary cases than in revision cases with bigger improvements in recent years. Overall, there was a 45% conversion rate in the primary group and 64% in the revision group. Both in the 200 primary cases and the 100 secondary cases the unpaired *t* tests between the recurrences and nonrecurrences for the Lund-Mackay scores were insignificant (Table V) ($P = .35$ and $P = .20$, respectively). There was no significant increase in recurrences or revisions in the polyp group, but there was a significant difference between the Lund-Mackay scores in the two groups (means of 7.51 and 11.41, respectively; $P < .001$).

DISCUSSION

Over nearly a 10-year period at SPSC we have been able to show a gradually improving trend toward minimizing recurrent frontal sinus disease and subsequent revision surgery with refinement of our operative techniques and our outpatient management of the patients. The fact that in over 80% of recurrent frontal sinus disease in the primary surgical group the situation was resolved without the need for further surgery (2004–2009 data) is a testament to the culture-directed topical management philosophy of dealing with postsurgical sinusitis at SPSC. Any mucopus identified endoscopically is cultured using either a Xomed suction trap (Medtronic Xomed Sinus Secretion Collector; Medtronic-Xomed, Jacksonville, FL), a Leukens trap, or a urethral wire swab (Fig. 2, A-C). Following this a "cocktail" of Nasacort and gentamicin is usually placed in the affected sinus under endoscopic guidance using curved cannulas. The final result of the culture is awaited before commencing any antimicrobial treatment and only if the patient continues to remain symptomatic. Increasingly, over the last 9 years there has been a move toward commencing patient-managed, culture-directed topical therapy such as cloxacillin irrigations for *Staphylococcus aureus* infections. In the presence of significant mucopus collections, an office sinus lavage is also performed using normal saline containing baby shampoo, budesonide, and gentamicin. Recurrent mucosal inflammation is frequently managed by saline irrigations containing budesonide, but not all cases of recurrent frontal sinus disease demonstrate mucopus or mucosal edema alone; osteoneogenesis can be a potent factor in causing recurrent disease and in worst cases can seal off the frontal sinus. This inflammatory response in the bone has a greater tendency to occur in revision cases where previous surgical intervention with denudation of the bone causing synechiae in conjunction with ongoing inflammatory disease can create a significant effect.[14]

In comparison to the evidence in the literature for recurrence of frontal sinus disease, our 19% rate sits favorably among other studies demonstrating a range

TABLE V.
Mean Lund-Mackay Scores Unpaired *t* Test Results.

	Recurrences	Nonrecurrences	*P* Value
Primary (SPH)	10.13	9.95	.35
Secondary (other)	7.39	9.14	.20

SPH = St. Paul's Hospital.

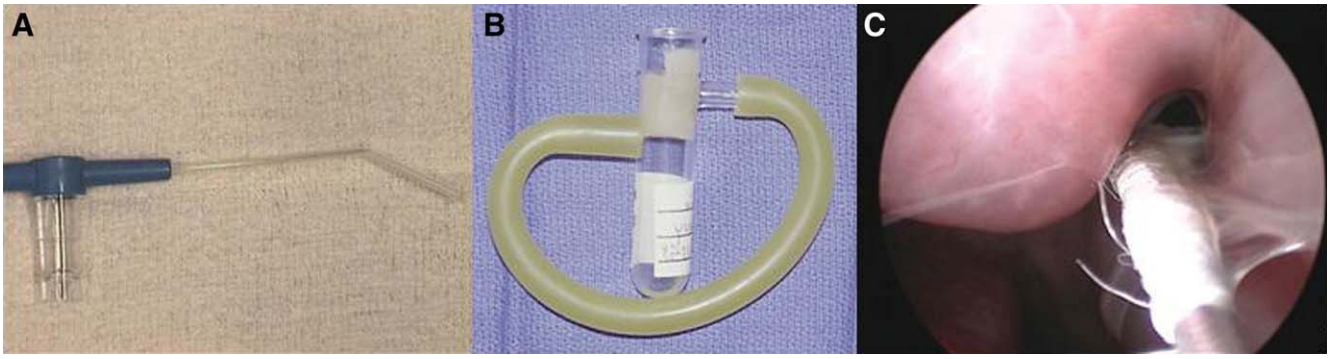

Fig. 2. (A) Xomed sinus secretion collector, (B) Leukens trap, (C) urethral swab. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

between 14%, as determined by evidence of endoscopic recurrence,[15] and 19% as determined radiologically on CT scanning.[3] For those cases requiring revision surgery, the Philadelphia group found in their series of 130 frontal sinusotomies that 10 required further intervention based on endoscopic findings and the ability to cannulate the frontal sinus.[16] More interestingly, their study found that the recurrent cases showed a higher grade of radiological disease than the nonrecurrent cases. This is in direct contrast to our findings whereby the preoperative Lund-Mackay score did not prove to be a useful predictor of recurrence; their radiological scoring was, however, specific for the frontal sinuses.

Looking at the more invasive procedures, Table VI shows that it is only the osteoplastic flap that has been shown to have better results in reducing recurrence and revision procedures,[17] but clearly this caries significantly more morbidity than the endoscopic approach and should be reserved for failed endoscopic approaches.

CONCLUSION

Frontal sinus disease can be managed surgically with a minimal endoscopic approach, and if recurrent disease occurs it can be managed medically in the clinic in over 80% of cases, avoiding more radical interventions.

TABLE VI.
Recurrence and Revision Rates for Other Surgical Approaches to the Frontal Sinus.

Technique	Author/Year	Recurrence Rate (%)	Revision Rate (%)
Modified Lothrop	Schlosser 2002[18]	32+	32
	Shirazi 2007[19]	23+	23
	Schulze 2002[20]	23	15
	Wormald 2003[5]	7+	7 [not all CRS]
	Ulualp 2009[17]	13+	13
Combined endoscopic and frontal trephine	Batra 2005[10]	14	1 [?]
	Hahn 2009[21]	57+	57
Osteoplastic flap	Ulualp 2009[17]	0	0
	Hahn 2009[21]	4+	4

CRS = chronic rhinosinusitis.

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