

Modified subtotal-Lothrop procedure for extended frontal sinus and anterior skull-base access: a case series

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Background: The endoscopic modified Lothrop procedure (EMLP) is well established for resistant frontal sinus disease and anterior skull base (ASB) exposure. However, this technique may be unnecessarily aggressive by removing avoidable sinonasal structures in select cases. Previously, in a cadaveric study, we proposed a modification of the EMLP, termed the modified subtotal-Lothrop procedure (MSLP), to access the ASB and to address complex frontal sinus disease, for which access to the bilateral frontal sinus posterior table is required. This study provides a step-by-step description of this technique, and presents our experience in 5 patients who underwent this approach.

Methods: A retrospective analysis was performed at a tertiary referral center on all patients undergoing endoscopic ASB resection and complex frontal sinus surgeries between May 2011 and May 2013. Of 8 patients identified who underwent an MSLP, 5 had at least 1-year follow-up.

Results: All patients underwent successful ASB exposure via the MSLP without complications and preservation of one frontal sinus recess. Adequate access to the bilateral posterior frontal sinus table was achieved in all cases. A patent frontal sinus drainage pathway could be assessed

endoscopically after a mean follow-up of 18.6 (range, 12–27) months.

Conclusion: The MSLP is a feasible approach for exposure of the ASB and accessing complex frontal sinus pathology. This modification provides adequate ASB exposure and surgical maneuverability similar to the EMLP, while preserving one frontal sinus recess. This modification was successful in providing adequate exposure and maneuverability as well as maintaining frontal sinus patency in this small cohort. © 2014 ARS-AAOA, LLC.

Key Words:

endoscopic modified Lothrop procedure; Lothrop procedure; modified hemi-Lothrop procedure; modified mini-Lothrop procedure; modified subtotal-Lothrop procedure; extended Draf IIB; case series; anterior skull base tumor; unilateral skull base tumor; hemi-skull base resection

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Over the last decade endoscopic approaches to the anterior skull base (ASB) and frontal sinus have progressed markedly. The endoscopic modified Lothrop procedure (EMLP) is commonly used for management of recurrent frontal sinusitis^{1–10} and ASB exposure.^{11–22} Nonetheless, the use of this procedure can lead to resection of salvageable sinonasal structures in select cases. With the increasing number of endoscopic ASB procedures being performed,^{16,18} and the need for sinonasal architecture preservation, we previously described a modification of the EMLP in a cadaveric model termed the modified subtotal-Lothrop procedure (MSLP) to access the ASB for recurrent chronic complex frontal sinus disease in which access to the bilateral posterior table of the frontal sinus is required while the contralateral frontal sinus recess (FSR) is

TABLE 1. Patients data and surgery results

Patient number	Age (years)	Sex	Pathology	Procedure	Follow-up (months)	Adjuvant treatment	Results
1	15	F	Osteoblastoma	R MSLP	26	–	NED
2	26	M	ACC	L MSLP	27	XRT	NED
3	81	M	ON	R MSLP	15	XRT	NED
4	53	F	ON	L MSLP	13	XRT	NED
5	37	M	Adenocarcinoma	R MSLP	12	XRT	NED

ACC = adenoid cystic carcinoma; L = left; MSLP = modified subtotal-Lothrop procedure; NED = no evidence of disease; ON = olfactory neuroblastoma; R = right; XRT = radiation therapy.

TABLE 2. Tumor location and extent

Patient number	Pathology	Location and extent
1	Osteoblastoma	R frontal sinus and anterior skull base
2	ACC	L ethmoid sinus with intracranial extension and extension into L lamina papyracea
3	ON	R nasal cavity, maxillary sinus, frontal sinus, ethmoid sinus, sphenoid sinus, and anterior skull base
4	ON	L nasal cavity, maxillary sinus, ethmoid sinus, and anterior skull base
5	Adenocarcinoma	R nasal cavity, ethmoid sinus, and anterior skull base

ACC = adenoid cystic carcinoma; L = left; ON = olfactory neuroblastoma; R = right.

left untouched.²³ In this study, we discuss our experience in a series of 5 patients who underwent this approach.

Patients and methods

Subjects

Between May 2011 and May 2013, all patients undergoing ASB tumor resection endoscopically by the senior authors (J.A.E. and J.K.L.) at University Hospital were retrospectively reviewed. Eighteen patients with ASB tumors underwent endoscopic resection. Eight patients with unilateral ASB tumors who underwent an MSLP were identified (the remaining patients underwent a standard EMLP for anterior exposure). Three of these 8 patients who underwent a MSLP had follow-up period of less than a year and were excluded from this analysis. Five patients who met the study criteria are discussed in this report. Their details are summarized in Tables 1 and 2. Demographic data, history, pathology, radiographic findings, and perioperative data were reviewed.

Surgical technique

The endoscopic MSLP, which we previously described,²³ begins by performing a standard unilateral frontal sinus exposure (Draf IIB) (Fig. 1C) with identification of the FSR and frontal sinus ostium of the ipsilateral (tumor) side. This is performed by finding the ipsilateral frontal sinus ostium and enlarging it anteriorly through removal of the agger nasi cell and posteriorly by removal of the anterior face of the bulla ethmoidalis. The superior medial head of the middle turbinate is subsequently resected

and the ipsilateral FSR is opened laterally until the lamina papyracea is reached. This is followed by complete resection of the floor of the frontal sinus and nasofrontal beak either with powered instrumentation (such as a high-speed drill or suction-rotation microdebrider),²⁴ Kerrison rongeurs (Integra, York, PA), or angled curettes. An endoscopic superior septectomy and frontal intersinus septectomy is subsequently performed (Fig. 1D, E) immediately anterior to the coronal plane of the posterior frontal sinus table. At this point, access to the ipsilateral and medial contralateral frontal sinus is achieved with exposure and adequate visualization of the bilateral frontal sinuses and ASB (Fig. 1F). While an EMLP would continue with dissection of the contralateral FSR, in a MSLP the contralateral FSR is preserved. In the case of a tumor, the lesion is then resected endoscopically using microsurgical techniques. The ASB defect created (Fig. 2) is subsequently repaired using a multilayered closure that includes a vascularized pedicled nasoseptal flap bolstered with gentamicin-soaked Gelfoam pledgets and Merocel (Medtronic Xomed, Jacksonville, FL) nasal packings covered with gentamicin, as described.^{12,25–33}

Postoperative care

Patients are treated with a third-generation cephalosporin or a penicillin-based antibiotic with a beta-lactamase inhibitor until the Merocel packings are removed at approximately 10 days postoperatively. Stool softeners and avoidance of activity that raises intracranial pressure (straining, nose blowing, etc.) are also used. No postoperative lumbar drainage was used in this cohort of

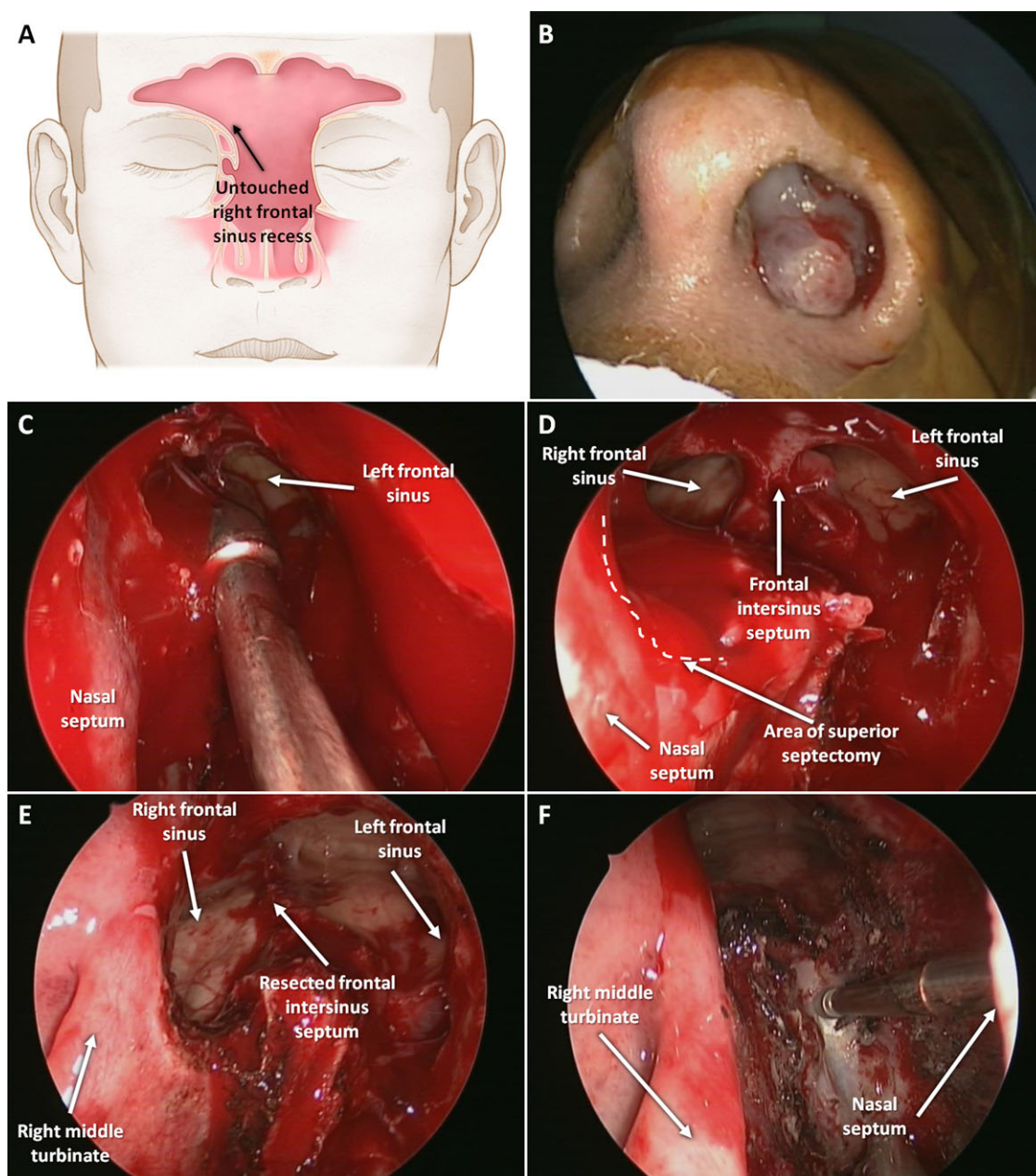


FIGURE 1. (A) Artwork in the coronal plane showing bilateral frontal sinus access with left MSLP with preservation of contralateral frontal recess. Endonasal view of intraoperative MSLP in patient number 5. (B) Initial intraoperative view of the lesion. (C) Using a 30-degree rigid endoscope, a left Draef IIIB is performed. (D) A superior septectomy is performed and the medial contralateral frontal sinus floor is resected. (E) The intersinus septectomy is subsequently performed. The right (contralateral) frontal sinus recess as well as the right middle turbinate are preserved. (F) View from the contralateral (right) nasal cavity after completion of left Draef IIIB, superior septectomy, and intersinus septectomy. Draef IIIB = unilateral frontal sinus exposure; MSLP = modified subtotal-Lothrop procedure.

patient to prevent negative pressure away from the multilayer repair.²⁶ Nonetheless, patients are asked to abstain from heavy activity or lifting anything more than 10 lbs for approximately 6 weeks. Postoperatively patients are examined with nasal endoscopy on an outpatient basis, with careful debridement to prevent manipulation of the repair.

Results

Five patients (2 females, 3 males) with unilateral ASB tumor resected endoscopically were identified. The mean age was

42.4 (range, 15–81) years. All 5 patients underwent successful ASB approach via an MSLP with adequate exposure and tumor resection. Four patients with malignant ASB lesions received postoperative radiation therapy. All patients had no evidence of disease on endoscopic examination after a mean follow-up of 18.6 (range, 12–27) months. No infection, mucocele formation, or epistaxis occurred. All patients were followed postoperatively with nasal endoscopy on an outpatient basis. All 5 patients had a patent MSLP opening at the last follow-up visit. The

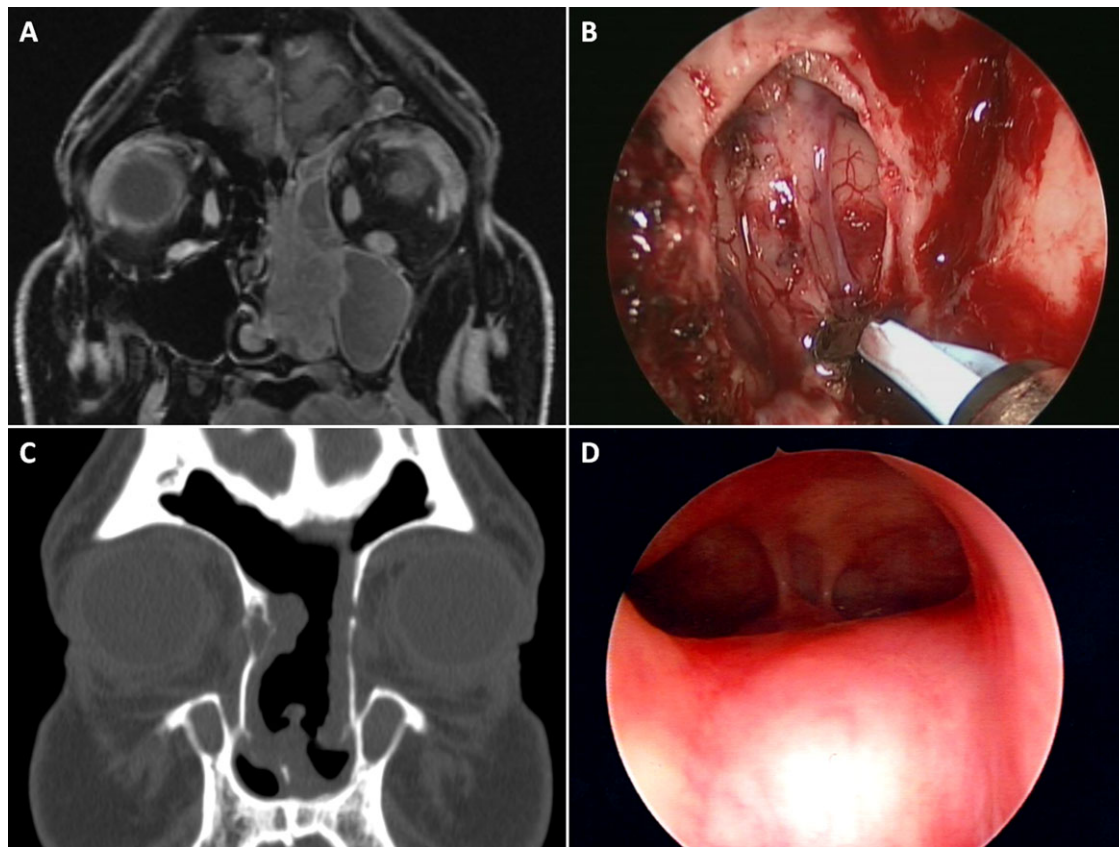


FIGURE 2. (A) Preoperative coronal T1-weighted gadolinium enhanced paranasal sinus MRI of patient number 5. (B) Intraoperative endoscopic view of the ASB defect after tumor resection. (C) Coronal postoperative CT scan of the same patient showing a patent MSLP. (D) Six-month postoperative endoscopic image of the patent frontal sinus cavity. ASB = anterior skull base; CT = computed tomography; MRI = magnetic resonance imaging; MSLP = modified subtotal-Lothrop procedure.

preserved frontal sinus recess was examined endoscopically both through the middle meatus inferiorly and the MSLP superiorly and found to be intact. One patient developed postoperative intranasal synechia after completion of radiation therapy. Another patient with an osteoblastoma of the right ASB (patient 2) had an enhancing nodular lesion at the site of the tumor resection 19 months later. This patient underwent endoscopic biopsy of the lesion with finding of chronic inflammation without evidence of osteoblastoma.

Discussion

The EMLP is well known for treatment of complex frontal sinus disease^{1-4,6-10,34} and as an approach technique for ASB tumor resection.^{11,12} Nonetheless, in cases of limited unilateral sinonasal/ASB tumors, the EMLP may lead to unnecessary resection of salvageable sinonasal structures. Previously, we have described 3 less invasive modifications of this technique termed the modified mini-Lothrop procedure (MMLP),³⁵⁻³⁷ the modified hemi-Lothrop procedure (MHLP),³⁸⁻⁴⁰ and the MSLP²³ to address specific frontal sinus and supraorbital ethmoid pathologies in which a complete EMLP is avoidable. The MSLP is designed specifically to provide exposure for access to the bilateral posterior frontal sinus table for unilateral ASB tumor resection with preservation of the contralateral FSR.

In this study, we demonstrate the ability of our previously described MSLP²³ to address this select patient population. Adequate access was obtained in all the cases with ability to perform binostril and bimanual dissection. There was ample space for tumor resection and subsequent repair of the ASB defect created. The MSLP is an ideal technique for large unilateral frontal sinus and ASB lesions requiring bilateral frontal sinus exposure and significant surgical maneuverability. Although all the cases included in this analysis were tumors, this approach can also be used for large posterior frontal sinus table encephaloceles. Though the EMLP would have provided adequate visualization and bimanual manipulation for resection of the tumors in this cohort, we felt that dissection of the contralateral FSR was unnecessary and could have potentially increased morbidity. Preserving the contralateral FSR ensures that in case of scarring and obstruction of the surgically manipulated ipsilateral recess, there remains a viable avenue for drainage of both frontal sinuses. A Draf IIB, MHLP, or MMLP alone would not have provided both the necessary exposure and surgical freedom in these scenarios. With a Draf IIB, only access to the ipsilateral FSR and frontal sinus cavity is provided, and surgical freedom is limited secondary to mononostril access. Addition of a frontal intersinus septectomy to a Draf IIB while keeping an intact nasal septum creates a MMLP.³⁵ With this variation, access to

bilateral posterior frontal sinus table is achieved, but surgical freedom is significantly limited due to mononostril access. Addition of a superior septectomy to the Draf IIB (MHLF) increases surgical freedom by allowing binostril bimanual access, as well as improved access to the far lateral frontal sinus via the superior septotomy window from the contralateral nasal cavity.^{38–40} Nonetheless, through preservation of the frontal intersinus septum, an MHLF does not provide access to the contralateral frontal sinus and would be limited for lesions that approach or cross the midline.^{38–40} The MSLP as we described includes both the addition of a superior septectomy and frontal intersinus septectomy to a Draf IIB with preservation of the contralateral FSR.²³ This modification provided adequate exposure and surgical maneuverability in all of the cases in this cohort with preservation of the integrity of the contralateral FSR. We note that in many cases the EMLP remains appropriate (indeed in our review period, the EMLP was used more often than the MSLP for ASB tumor resection). However, we feel that this novel technique (the MSLP) has a

place in the armamentarium of the endoscopic skull base surgeon.

In this study, the exposure provided by the MSLP was adequate for resection of unilateral ASB tumors without the need for a standard EMLP or external ASB approaches. However, this study is subject to all limitations inherent to a retrospective study. Additional limitations include the small sample size, the lack of a control group, and the short follow-up period. Further clinical validation will be necessary in larger prospective models.

Conclusion

The MSLP is a feasible approach for exposure of the ASB and access to complex frontal sinus pathology. This modification provides similar ASB exposure and surgical maneuverability to the EMLP, while preserving one FSR. This modification was successful in providing adequate exposure and maneuverability as well as maintaining frontal sinus patency in this small cohort of patients. ④

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MEETING ANNOUNCEMENT

The 33rd meeting of the International Society of Inflammation and Allergy of the Nose (ISIAN) and 15th meeting of the International Rhinologic Society will be held in Dubai November 20th through 24th 2014. Additional information and registration is available through the meeting website <http://isian-irs-pars2014.org/>