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The Outside-In Approach to the Modified Endoscopic Lothrop Procedure

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Objectives/Hypothesis: Drilling in modified endoscopic Lothrop procedure (MELP) is traditionally described as commencing from the frontal recess (FR). This is challenging when the FR is involved by tumor, inflammatory disease, or scarring. The outside-in MELP, where the limits of the sinusotomy are first defined and the FR is addressed last, is described.

Study Design: Case-control study.

Methods: Patients undergoing MELP, using the standard or outside-in approach, for inflammatory disease or endoscopic skull base surgery were assessed. Data were collected on demographics, disease characteristics, and FR involvement. Operative time was calculated from intraoperative video recording. Time points recorded were times to frontal sinus and recess connected for outside-in MELP and completion of Lothrop cavity for both groups. Perioperative complications (infection, skin breach or contusion, surgical emphysema, orbital bleeding, cerebrospinal fluid leak, and intracranial complications) were recorded.

Results: Thirty patients (67% female) with a mean age ± standard deviation of 56.0 ± 10.8 years underwent MELP (24 outside-in, six standard). Time for Lothrop completion was shorter for outside-in MELP (30.60 ± 14.10 minutes vs. 69.66 ± 64.52 minutes, $P = .002$). Among outside-in MELP, mean time to frontal sinus floor discovery was 8.41 ± 6.29 minutes, to recess connected 26.50 ± 12.45 minutes, and were similar regardless of pathology. The time for Lothrop cavity completion was shorter for tumor cases (24.63 ± 6.49 minutes) than for chronic rhinosinusitis without polyps (35.87 ± 20.18 minutes) and chronic rhinosinusitis with polyps (34.62 ± 11.56 minutes) ($P = .05$). One patient had skin edema. No other complications were recorded.

Conclusions: The outside-in MELP is technically feasible and safe. Its advantage is a wide approach to the frontal sinus with development of the Lothrop cavity en route resulting in short predictable operative times. Defining the limits of the dissection early provides a robust and efficient approach.

Key Words: Endoscopy, frontal sinus, pathology, surgery, complications, physiopathology, paranasal sinus, neoplasms, otorhinolaryngologic surgical procedures, postoperative.

Level of Evidence: 3b.

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INTRODUCTION

Over the last two decades, the modified endoscopic Lothrop procedure (MELP) has become established as an option in managing recalcitrant frontal sinus inflammatory disease,[1] mucoceles,[2,3] and cerebrospinal fluid (CSF) leaks[4] in the frontal sinus. More recently, it has been applied for endoscopic management of frontal sinus tumors[5,6] and as a component of the endoscopic skull base surgery (ESBS). Additionally, the access afforded by the Lothrop cavity facilitates postoperative tumor surveillance[6,7] and topical therapy.[8–10] This broadened application of MELP reflects the evolution of the concept of this procedure as a surgical technique for access to the frontal sinus rather than a conclusive treatment for a particular pathology.

Compared with the osteoplastic flap approach (OPF), MELP avoids the problems associated with an external approach[7] including cutaneous scarring, scalp hematoma,[11] embossment,[12] and cosmetic deformity. Although the rate of CSF leak for MELP was between 6.7% and 11.1% in earlier case series,[13–16] this complication is now rare with MELP performed in an era of modern endoscopes and instruments.[1,17,18]

The limits of the endoscopic Lothrop cavity are well recognized.[14] Laterally, these are the orbital plates of the frontal bone and periosteum of the skin over the frontal process of the maxilla on both sides. Posteriorly, the first olfactory fascicle on each side demarcates the forward projection of the olfactory bulb. Anteriorly, the

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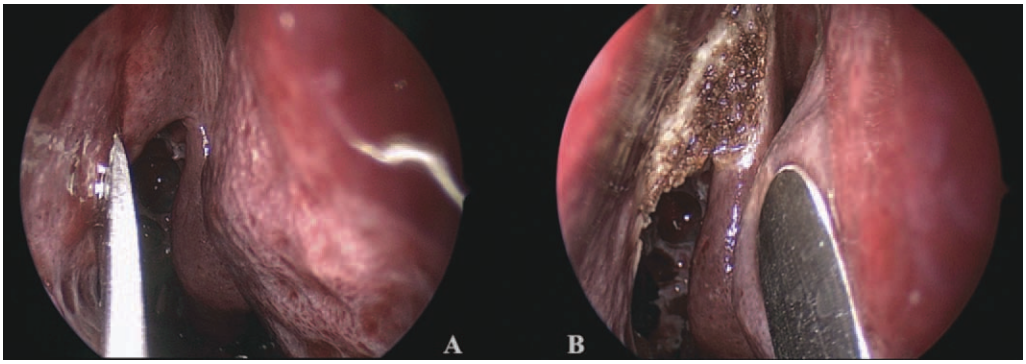

Fig. 1. (A) The area over the frontal process of the right maxilla where mucosa is to be removed lies medial to the plane of the medial orbital wall. (B) Mucosa is removed over the previously defined area on one side.

dissection is taken to the plane of the anterior table of the frontal sinus.

Traditionally, bony removal follows the identification of one frontal recess as the first step; the less challenging side is usually chosen. This often involves the use of angled endoscopes.[19,20] However, finding the frontal recess can be difficult,[16] as severity of disease and scarring is typical in patients considered for MELP.[21] For ESBS, initial dissection in the frontal recess is not often practical when tumor occupies this area.

Commencement of drilling away from the frontal recess is not a new concept, and it has been suggested as a maneuver when the frontal recess is not identified.[22] We describe an approach that avoids initial dissection in the frontal recess, where the anatomy is the tightest and most challenging. Bone removal is performed below the frontal sinus floor to the periosteum of the skin until wide access is developed, with the dissection limits defined early, much like the approach to modified radical mastoidectomy in otology.

The aims of this article were to describe the characteristics of outside-in MELP and to compare the operative times and perioperative complications for outside-in versus standard MELP, focusing on the approach to bone removal during the procedure.

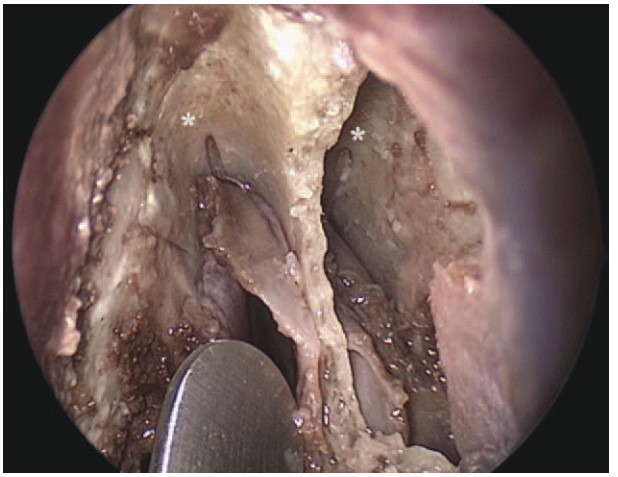

Fig. 3. Removal of mucosa of the roof of the nasal cavity. Emissary veins (marked with asterisks) should not be mistaken for the olfactory fascicles.

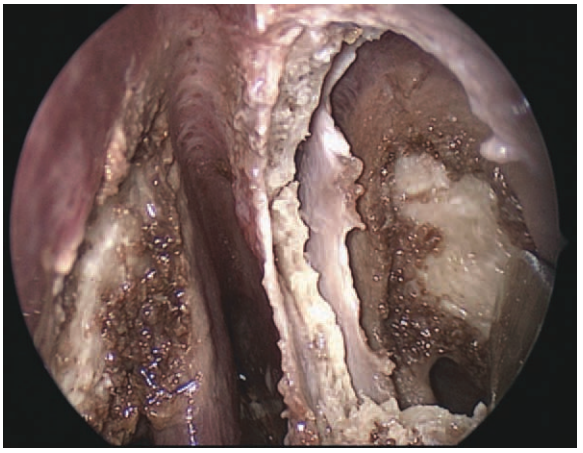

Fig. 2. The anterior septal window is created, staying in the upper half to one-third of the middle turbinate. The posterior limit is the first olfactory fascicle.

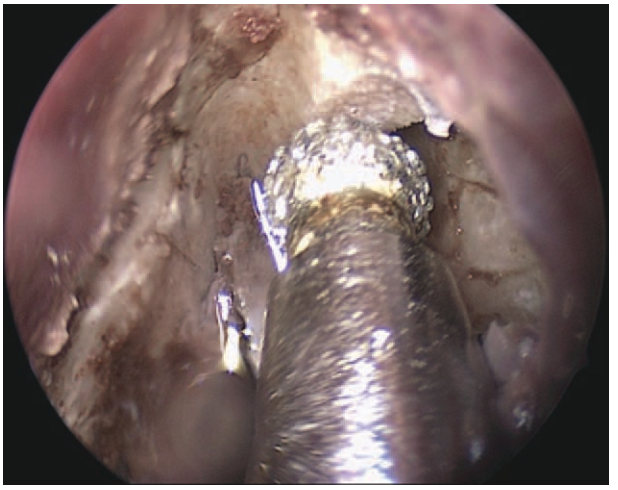

Fig. 4. The remaining portion of the upper bony septum is drilled down.

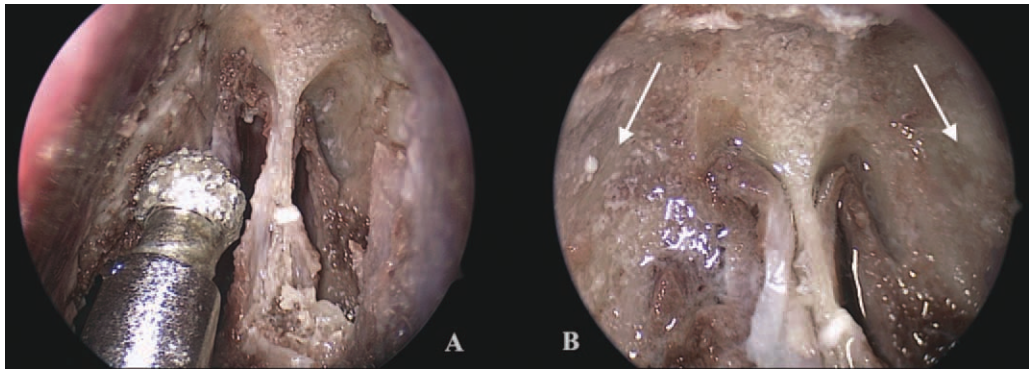

Fig. 5. (A) Drilling starts at the frontal process of the maxilla to the periosteum laterally. (B) The periosteum underlying the skin is identified on both sides (white arrows).

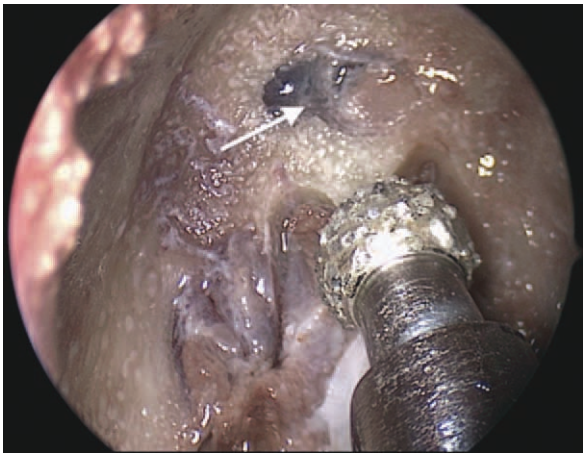

Fig. 6. Bone is removed between the lateral limits and the mucosa of the floor of the frontal sinus is quickly discovered (white arrow).

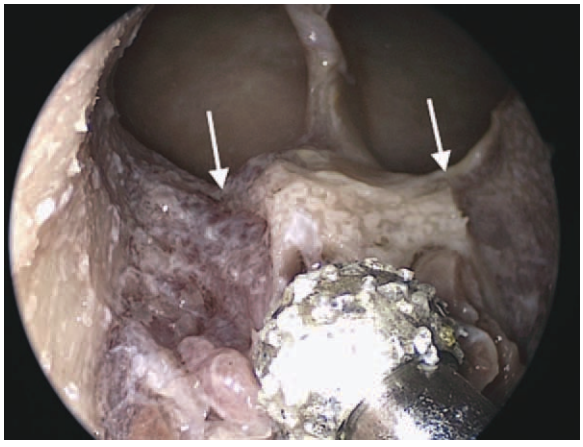

Fig. 7. The floor of both frontal sinuses and the interfrontal sinus septum are removed, resulting in a wide frontal cavity. Drilling has occurred anterior and superior to the frontal recess (the direction indicated by white arrows), which always remains between the drill head and the turn of the skull base. Drilling in the midline is limited posteriorly by constantly maintaining awareness of the previously identified first olfactory fascicles.

MATERIALS AND METHODS

A case-control study was performed of consecutive patients who underwent MELP by the same surgeons. Institutional review board approval was obtained for the study. All cases with complete video recording of MELP were included. Cases where the operative steps were executed as described for outside-in approach (described below) were differentiated from those that were not and classified as outside-in or standard MELP, respectively

Data were collected on gender, age, history of previous frontal sinus surgery, disease characteristics, and degree of frontal

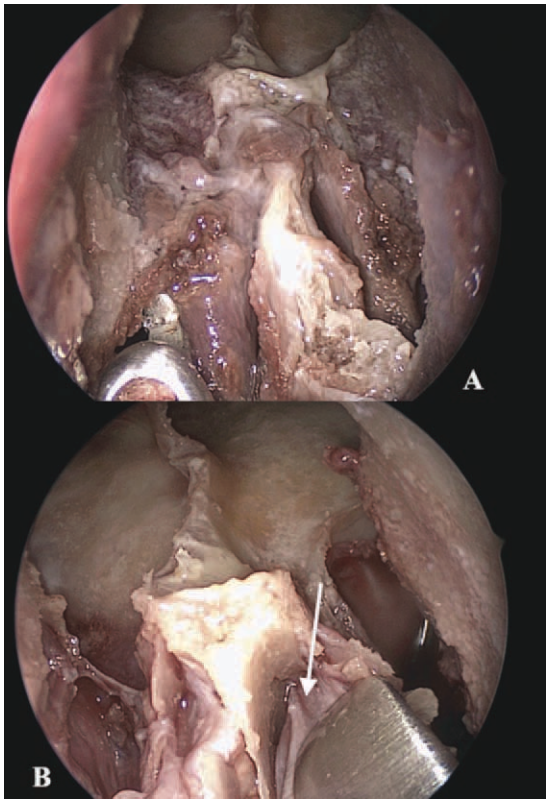

Fig. 8. (A) The frontal recess is connected to the previously drilled Lothrop cavity with a 2-mm Kerrison rongeur. (B) The Lothrop cavity is completed and lowered toward the posterior limit (white arrow indicates the position of the first olfactory neuron).

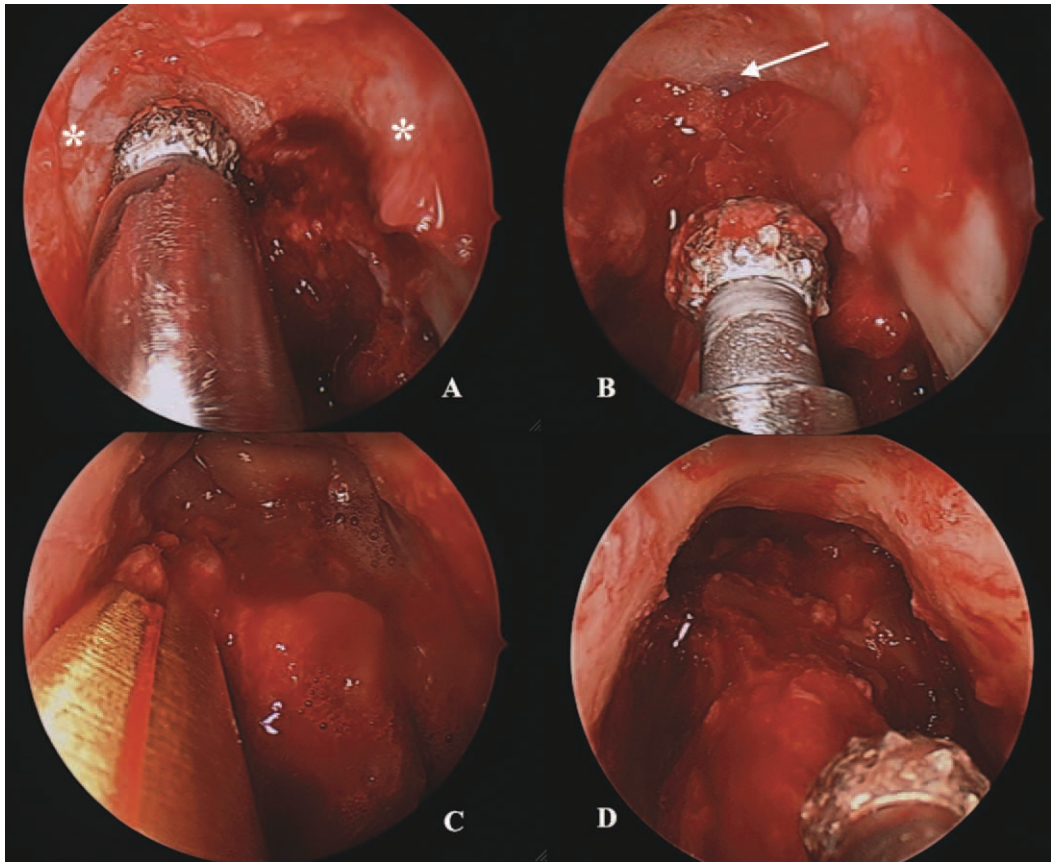

Fig. 9. Intraoperative pictures of a patient who had outside-in modified endoscopic Lothrop procedure for persistent nasal polyposis. (A) The frontal process of the maxilla has been drilled, and the periosteum (white asterisks) of the skin is identified on both sides. (B) The frontal sinus mucosa has just been visualized (white arrow), and subsequent drilling occurs between the periosteum bilaterally until the whole frontal sinus floor is removed before entering the mucosa. (C) The frontal recess is connected to the previously drilled Lothrop cavity with a 2-mm Kerrison rongeur. (D) The Lothrop cavity is completed.

recess obstruction. For outside-in MELP, the intraoperative times were recorded for time to frontal sinus discovered, time to frontal recess connected, and time for completion of Lothrop cavity. For standard MELP, operative time was recorded from the commencement of drilling to completion of the Lothrop cavity. Operative time was calculated from intraoperative video recording.

As this study focused on the application of MELP in a heterogenous group of patients requiring Draf 3 procedure for varying pathologies, only perioperative outcomes were included. The incidence of infection, skin breach or contusion, surgical emphysema, orbital bleeding, CSF leak, and intracranial complications was recorded.

Patients were classified broadly as either chronic rhinosinusitis without polyps (CRSsNP), chronic rhinosinusitis with polyps (CRScNP), or as part of tumor surgery (ESBS).

TABLE I.
Surgical Steps and Tips for the Outside-In Modified Endoscopic Lothrop Procedure.

Step No.	Surgical Step	Figure No.	Tip
1	Remove mucosa over frontal process	1A,B	Use the medial orbital wall as the lateral limit
2	Create septal window	2	Stay in the upper half of the middle turbinate and use the first olfactory fascicle as the posterior limit
3	Remove mucosa of nasal cavity underlying the floor of the frontal sinus	3	Do not mistake the emissary veins for the olfactory fascicles
4	Drill down the remaining upper bony septum	4	Gives wide access
5	Find the periosteum on each side	5A,B	Develop the plane on a broad front gives wider access
6	Remove the bone between the lateral limits	6	Keep a broad front and the sinus floor is very quickly discovered
7	Continue to remove bone anterior to the frontal recess	7	Have confidence that the recess still lies between the surgeon and anterior cranial fossa
8	Remove the bone between the created cavity and the true frontal recess	8A,B	Complete the cavity, with mucosal care if required, using a 2-mm Kerrison ronguer

Surgical Technique for the Outside-In MELP

The following section describes the surgical technique illustrated with photographs from a cadaveric dissection (Figs. 1–8). On the first side, the mucosa over the frontal process of the maxilla is removed medial to the plane in line with the medial orbital wall (Fig. 1A,B). The anterior septal window is created anterior to the insertion of the middle turbinates at the level of the upper half to upper one-third of the middle turbinate to allow bilateral access (Fig. 2). This dissection is anterior to the first olfactory fascicle on each side, which can be discovered posteriorly if required (Fig. 3).

A 0° endoscope and a 5-mm, 15° diamond burr is used throughout the entire case. The superior bony septum is drilled down to give a smooth working surface (Fig. 4). Dissection starts at the demucosalized area on the frontal process of the maxilla (Fig. 5A). This defines the baseline time point. This is

TABLE II.
Characteristics of Patients, Diagnoses, and Involvement of the Frontal Recess.

Patient	Age, yr	Sex	MELP Approach	Diagnosis	Previous Operations	Involvement of Frontal Recess
1	49.8	F	Outside-in	CRScNP	2 previous ESS	Occupied by nasal polyps
2	54.4	F	Outside-in	a) Sequestrum (frontal sinus); b) CRSsNP	Craniotomy for cerebral aneurysm; previous ESS for obstructed right frontal sinus	Obstructed by scar on right side
3	60.4	F	Outside-in	a) Ethmoid osteoma; b) CRScNP	1 previous ESS	Occupied by nasal polyps
4	77.6	M	Outside-in	CRSsNP	Cranioplasty with frontal sinus obliteration; revision cranioplasty for frontal mucocele	Bilateral obliteration
5	47.7	F	Outside-in	Sinonasal SCC T4a	Nil	Occupied by tumor bilaterally
6	61.9	F	Outside-in	CRScNP	3 previous ESS	Occupied by nasal polyps
7	52.9	F	Outside-in	CRScNP	2 previous ESS	Occupied by nasal polyps
8	64.0	F	Outside-in	Massive IP*	Nil	Occupied by tumor bilaterally
9	59.4	F	Outside-in	CRScNP	7 previous ESS	Occupied by nasal polyps
10	66.8	M	Outside-in	Atypical meningioma‡	2 previous craniotomies	Occupied by tumor on right side
11	36.6	F	Outside-in	CRScNP	2 previous ESS	Occupied by nasal polyps
12	58.4	F	Outside-in	CRSsNP	1 previous ESS	Stenosed; lateralized right middle turbinate
13	61.2	M	Outside-in	CRScNP	3 previous ESS	Occupied by nasal polyps
14	49.2	F	Outside-in	CRScNP	5 previous ESS	Occupied by nasal polyps
15	54.8	M	Outside-in	ONB (Kadish C)‡	1 previous ESS	Occupied by tumor on left side
16	33.6	F	Outside-in	CRScNP	2 previous ESS	Occupied by nasal polyps
17	48.3	M	Outside-in	Ethmoid SCC T4a§	Nil	Occupied by tumor
18	72.0	M	Outside-in	CRScNP	1 previous ESS	Occupied by nasal polyps
19	56.4	M	Outside-in	Frontal mucocele	1 previous ESS	Scarred off on side of mucocele
20	31.9	F	Outside-in	CRScNP	1 previous ESS	Unknown
21	32.1	M	Outside-in	CRScNP	1 previous ESS	Occupied by nasal polyps
22	59.8	M	Outside-in	ONB (Kadish C)‖	Nil	Occupied by tumor on left side
23	41.3	F	Outside-in	Frontal mucocele	1 previous ESS	Scarred off on side of mucocele
24	56.8	F	Outside-in	CRScNP	1 previous ESS	Occupied by nasal polyps
25	26.5	M	Standard	CRScNP	1 previous ESS	Scarred off left frontal recess
26	60.6	F	Standard	CRScNP	2 previous ESS	Obstructed with polyps
27	45.3	F	Standard	Massive IP¶	Nil	Occupied by tumor
28	29.5	M	Standard	CRScNP	1 previous ESS	Scarred off right frontal recess
29	46.4	F	Standard	ONB (Kadish C)	Nil	Occupied by tumor
30	69.0	M	Standard	Massive IP#	5 previous endoscopic resections	Occupied by tumor

*Large inverted papilloma filling both nasal vestibules, with multiple areas of skull base erosion on imaging.
†Atypical meningioma; endonasal approach as part of staged resection for removal of nasal and right orbital involvement.
‡Olfactory neuroblastoma (Hyams grade 2); with intracranial and left medial orbital wall involvement.
§Squamous cell carcinoma; with frontal lobe dura, left medial orbital wall, and left nasal vestibule involvement.
‖Olfactory neuroblastoma with minimal dural involvement.
¶Large inverted papilloma filling right frontal sinus, right supraorbital ethmoid cell, right ethmoid roof.
#Large inverted papilloma involving right ethmoid roof extending along floor and lateral wall of right frontal sinus.
MELP = modified endoscopic Lothrop procedure; F = female; CRScNP = chronic rhinosinusitis with nasal polyps; ESS = endoscopic sinus surgery; SCRSsNP = chronic rhinosinusitis without nasal polyps; M = male; SCC = squamous cell carcinoma; IP = inverted papilloma; ONB = olfactory neuroblastoma.

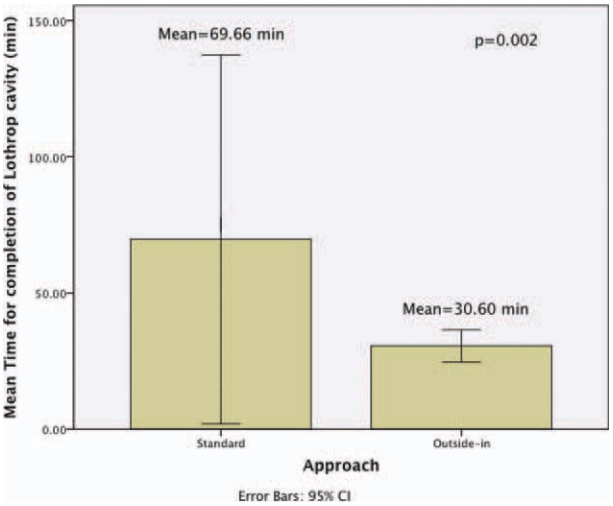

Fig. 10. Bar chart of mean time (minutes) for completion of Lothrop cavity versus approach for modified endoscopic Lothrop procedure (MELP). Time for completion of Lothrop was 30.60 ± 14.10 minutes and 69.66 ± 64.52 minutes for outside-in versus standard approach MELP ($P = .002$). CI = confidence interval.

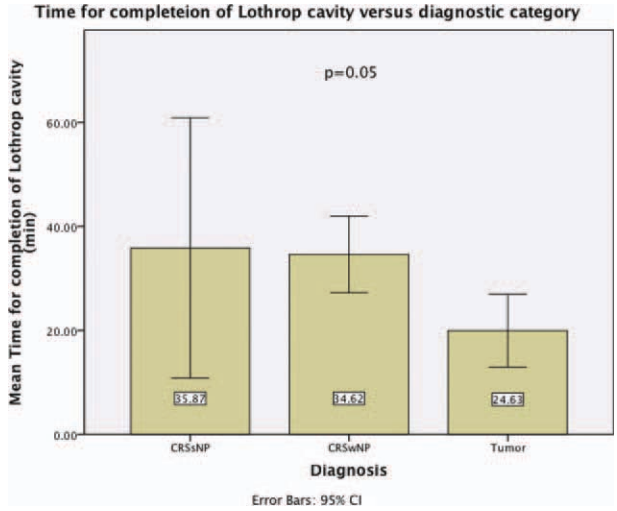

Fig. 12. Bar chart of mean time to completion of Lothrop (minutes) versus diagnosis. The time for completion of Lothrop cavity was 24.63 ± 6.49 minutes for tumor cases, 35.87 ± 20.18 minutes for CRSsNP and 34.62 ± 11.56 minutes for CRSwNP ($P = .05$). CRSsNP = chronic rhinosinusitis without polyps; CRSwNP = chronic rhinosinusitis with polyps; Tumor = tumor cases; CI = confidence interval.

continued laterally until the periosteum of the overlying skin is identified on one side and then on the contralateral side (Fig. 5B). A wide operative field is quickly developed as the bone is removed between these lateral margins. The mucosa of the floor of the frontal sinus is rapidly identified, and this step defines the first time point (Fig. 6). Bone removal is continued on a broad front, avoiding entry into the frontal sinus mucosa until there is wide access to the floor of the frontal sinus on both sides. The dissection is continued anterior and superior to the frontal recesses laterally and the first olfactory fascicle medially. This ensures that the frontal recess and inferior part of the frontal sinus always lies between the drill head and the skull base. The floor of the frontal sinus is removed (Fig. 7). A thin shelf of bone that remains anteriorly at the frontal recess is removed using a 2-mm Kerrison rongeur bilaterally, and completion of this step defines the second time point (Fig. 8A). At this stage, an angled endoscope may be used, if required, for better visualization of the anterior wall, which defines the anterior limit of the cavity. Any remaining bony overhang in the frontal beak area is removed. The interfrontal sinus septum is lowered toward the first olfactory fascicle (Fig. 8B) to achieve the final Lothrop cavity and the final time point.

An example of the approach in a surgical case is demonstrated in Figure 9. Image guidance was available in many cases, as they included intradural resections of tumor, but it is not used to direct the surgery described, which is based on anatomical landmarks. Table I summarizes the surgical steps for the outside-in MELP.

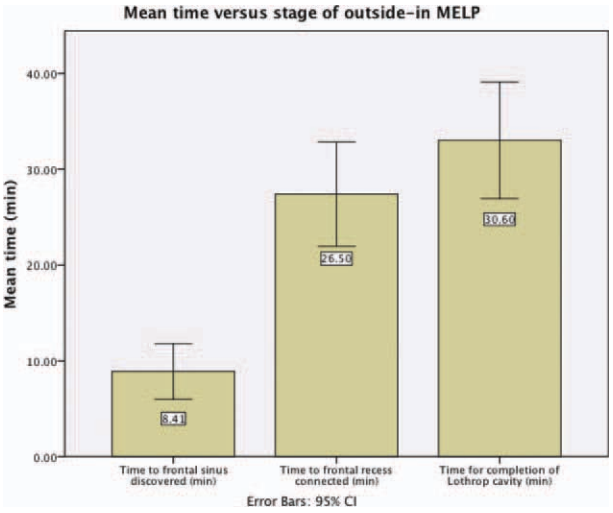

Fig. 11. Bar chart of mean time (minutes) versus stage of outside-in MELP. Mean time to frontal sinus floor discovery was 8.41 ± 6.29 minutes, to recess connected 26.50 ± 12.45 minutes, mean time to completion of Lothrop 30.60 ± 14.10 minutes. CI = confidence interval.

RESULTS

Characteristics of Patients and Pathology

Thirty patients (67% female) with a mean ± standard deviation age of 56.0 ± 10.8 years underwent MELP (24 outside-in, six standard) during the defined period. Altogether, 60% of the patients had inflammatory disease (CRSsNP = 3, CRScNP = 15), 7% had frontal mucocele, and the remaining patients had the procedure as part of ESBS (Kadish C esthesioneuroblastoma (three), meningioma (one), massive inverted papilloma (three), ethmoid skull base osteoma (one), T4a squamous cell carcinoma (SCC) from the ethmoid sinus (one), and T4a SCC from the nasal septum (one). All inflammatory disease cases were revision procedures, with one patient having had seven previous endoscopic sinus procedures (Table II).

TABLE III.
Table of Studies on Modified Endoscopic Lothrop Procedure Focusing on Disease Characteristics, Surgical Approach, and Perioperative Complications.

First Author	Year	No. of Patients	Patient Characteristics	Surgical Technique	Mean Operative Time, min	Perioperative Complications Related to MELP Approach
Harvey (current)	2012	18	66.7% CRS, 33.3% tumor	Outside-in approach	26.92 ± 11.20	5.6% transient skin edema
Yoon[5]	2009	6*	IP	Not described	NR	16.7% CSF leak†
Zhang[6]	2008	2	IP	Traditional approach	NR	None
Nakagawa[27]	2007	6	Mucocele	Traditional approach	NR	None
Shirazi[18]	2007	97	94% CRS, 4% IP, 2% osteoma	Traditional approach	120	1.0% CSF leak
Tran[17]	2007	77	Frontal CRS	Traditional approach with frontal trephination	NR	2.6% CSF leak
Banhiran[24]	2006	72	89% frontal CRS, 11% tumor	Traditional approach using angled bone curette, thru-cut forceps, and frontal rasp without drilling	NR	None
Dubin[23]	2005	3	Frontal CRS	Traditional approach using cutting punches without drilling	NR‡	NR
Khong[26]	2004	21	Frontal mucocele	Traditional approach	NR	14.3% epistaxis, adhesions
Samaha[22]	2003	66	Frontal CRS or mucocele	Traditional approach	NR	4.0% epistaxis
Stankiewicz[28]	2003	10	Persistent frontal CRS after OPF with fat obliteration	Not described	NR	None
Wormald[1]	2003	83	62.8% frontal CRS, 30.1% mucocele, 4.8% previous frontal sinus trauma, 2.4% osteoma	Traditional approach with frontal trephination	240§	None
Wormald[2]	2003	16	Persistent frontal CRS after OPF with fat obliteration	Traditional approach with frontal trephination	NR	None
Wormald[3]	2003	14	Frontal sinusitis with complications	Traditional approach with frontal trephination	NR	None
Wormald[29]	2003	13	Frontal CRS with the extensive cell pneumatization into frontal ostium	Traditional approach with frontal trephination	NR	None
Schlosser[30]	2002	54	93% frontal CRS, 3.7% mucocele, 1.8% IP, 1.8% osteoma	Traditional approach	NR	1.9% tension pneumocephalus, 9.3% others‖
Schulze[16]	2002	13	Frontal CRS	Traditional approach	NR	7.7% CSF leak, 15.4% anosmia
Casiano[25]	1998	21	Frontal CRS	Traditional approach using angled bone curette, thru-cut forceps and frontal rasp without drilling	131.4	None

*Subset of patients who had surgery for frontal sinus inverted papilloma and underwent MELP.
†CSF leak occurred when site of IP attachment on posterior table of the frontal sinus was being drilled down.
‡Authors commented that the use of through-cutting instruments instead of drills resulted in extra time required.
§Longer operative time occurred when training fellows and with the initial 35% of patients.
‖Nasal bone dehiscence, posterior table dehiscence without CSF leak, epistaxis, philtral pressure ulcer.
MELP = modified endoscopic Lothrop procedure; CRS = chronic rhinosinusitis; IP = inverted papilloma; NR = not reported; CSF = cerebrospinal fluid; Traditional approach = frontal sinusotomies followed by drilling the floor and the beak and frontal septectomy; OPF = osteoplastic flap.

Operative Times

The mean time for completion of Lothrop for outside-in and standard MELP were 30.60 ± 14.10 minutes versus 69.66 ± 64.52 minutes ($P = .002$) (Fig. 10). Among outside-in MELPs, mean time to frontal sinus floor discovery was 8.41 ± 6.29 minutes, to recess connected 26.50 ± 12.45 minutes, and were similar regardless of pathology (Fig. 11). The time for completion of Lothrop cavity was shorter for tumor cases (24.63 ± 6.49 minutes) than for CRSsNP (35.87 ± 20.18 minutes) and CRScNP (34.62 ± 11.56 minutes) ($P = .05$) (Fig. 12).

Perioperative Outcomes

One patient who had outside-in MELP had early minor postoperative skin edema, which resolved over 1 week without intervention. No bleeding, infective, CSF leak, orbital, or intracranial complications were otherwise recorded.

DISCUSSION

MELP is an established technique for accessing the frontal sinus for a variety of pathologies (Table III).[1–3,5,6,1–18,22–30] Improvements in endoscopic instrumentation and technique have allowed MELP to be performed with equivalent, if not better, outcomes than OPF.

The pivotal concept in the outside-in MELP is that the dissection is not related to frontal recess anatomy, and the recess is always between surgeon and skull base until the end of the procedure.[16] There are several advantages to this approach. First, it maybe impractical to commence drilling at the frontal recess when it is occupied by tumor or previously obliterated. Second, bleeding from inflamed mucosa is minimized by avoiding early entry into the frontal sinus. Third, a wide angle of approach that allows efficient drilling with a 5-mm diameter burr is facilitated by early identification of limits of the Lothrop cavity (skin-skin-first olfactory fascicle). Fourth, there is often very little additional dissection required after connection of the frontal recess, as the Lothrop cavity is created en route in the outside-in approach. These advantages translate into time-efficient completion of the Lothrop cavity, which is crucial if the MELP is part of ESBS. Of note in our case series, the time for completion of outside-in MELP was the shortest for ESBS cases.

As the focus of this article is on the approach to bone removal in MELP, the beginning time point was defined as the commencement of drilling and deliberately excludes parts of the operation not directly involving bone removal. This was chosen to minimize confounding by the heterogeneity in the pathology and prior frontal recess surgery.

In the present study, the mean time for the outside-in approach was shorter and more predictable than with the standard procedure. The mean operative time for MELP in our study cannot be directly compared with that of standard MELPs previously reported[18,25] because the operative times in those reports included other operative components (e.g., creation of the anterior septal window and removal of mucosa over the frontal recess). The use of internal controls in our study, where any maneuver employed to define the frontal recess (e.g., frontal dissection, probing, trephination) was excluded, allows a meaningful comparison to be made.

The outside-in MELP was not associated with any major perioperative complications, a finding that is pertinent to the concept of an approach that does not compromise patient safety. The foundations of the outside-in approach rest in systematic identification of key anatomical landmarks at the beginning of the operation. Just as when the procedure is performed in the standard approach, sound knowledge of the surgical anatomy and orientation is essential. Early development of a wide approach allows direct visualization of the posterior table of the frontal sinus (anterior skull base), with the frontal sinus lying between the drill head and the skull base. Dissection of the frontal recess, the narrowest part of the anatomy, is performed last after achieving access that allows good visualization of the position of the ethmoid roof in relation to the posterior frontal table.

Drilling from anterior to posterior at the frontal may be viewed with concern with regard to the risk of injury to the skull base. Importantly, it is because the dissection starts anterior to the frontal recess that the frontal recess or lower part of the frontal sinus will always lies between the skull base and the drill head. Only by drilling on the septum inferiorly can the surgeon injure the skull base. However, this is avoided by identification of the first olfactory fascicle and the posterior edge of the septal window created anterior to the cribriform.

Although stereotactic image guidance is helpful in confirming surgical landmarks, the approach described is based on identifying a sequence of fixed anatomical landmarks, and as in all endoscopic sinus surgery, it does not rely on image guidance to direct surgical dissection. Surgical steps, such as identification of the periosteum, are not significantly assisted by image-guided surgery.

CONCLUSION

The outside-in EMLP is a technically feasible and safe procedure. Its advantage lies in facilitating a wide approach to the frontal recess and efficient development of the Lothrop cavity en route, resulting in predictable operative times. Defining the limits of the dissection early provides a robust approach.

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