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Basal Lamella Relaxing Incision Improves Endoscopic Middle Meatal Access

Anne E. Getz, M.D.* and Peter H. Hwang, M.D.**

*Washington University, Department of Otolaryngology—Head and Neck Surgery, 660 S. Euclid Ave., Campus Box 8115, St. Louis, MO 63110, Tel: 314-747-3742, Fax: 314-362-7522, getza@ent.wustl.edu

**Stanford University, Department of Otolaryngology—Head and Neck Surgery, 801 Welch Rd., MC 5739, Stanford, CA 94305, phwang@ohns.stanford.edu

Abstract

Background—Lateralization of the middle turbinate is a commonly cited factor leading to failure of functional endoscopic sinus surgery (FESS). Inadequate medialization during FESS may require repeat intraoperative attempts, and may lead to destabilization and mucosal trauma. A novel technique is described that increases middle meatal area and provides more definitive medialization at the outset of FESS.

Methods—Twenty-nine middle turbinate medializations were prospectively evaluated in 18 consecutive patients undergoing primary endoscopic sinus surgery. Three intra-operative images of the middle meatus were obtained in the native position, after Freer medialization, and after basal lamella relaxing incision (BLRI). Measurements of middle meatal area were then calculated in a blinded and randomized fashion.

Results—Distances measured from the middle turbinate to the lateral nasal wall for each position ranged from 0 to 8 mm (median = 3.00 mm) for the native position, 0.5 to 10 mm (median = 5.00 mm) for Standard Freer medialization, and 3 to 21 mm (median = 10.00 mm) for BLRI. Friedman's ANOVA showed that there was significant difference between the three measurements, and the post-hoc Wilcoxon signed-ranks tests showed that BLRI distance [median=10, 95% CI (7 to 11.2)] was significantly larger than both Standard Freer [median=5, 95% CI (4 to 6.2)] and Native [median=3, 95% CI (2 to 3)] and that Standard Freer was significantly larger than Native (all p-values <0.001).

Conclusions—BLRI is a safe, controlled technique that provides significantly greater medialization of the middle turbinate compared to standard medialization techniques. BLRI significantly enhances the operative space within the middle meatus.

Keywords

Paranasal Sinuses; Nasal Sinuses; Sinuses; Turbinates; Procedures; Techniques; Operative Procedures

Correspondence to: Anne E. Getz.

The study was performed at Stanford University.

The authors have no conflicts of interest or financial disclosures to declare.

Introduction

Lateralization of the middle turbinate causing occlusion of the middle meatus is a potential adverse outcome of functional endoscopic sinus surgery (FESS). Scarring of the middle turbinate to the lateral nasal wall cannot only hinder post-operative visualization and debridement, but may also obstruct the anterior ethmoid and frontal sinuses leading to iatrogenic rhinosinusitis. Middle turbinate lateralization has been cited as one of the most common factors leading to FESS failure, with an incidence ranging from 22–78%^{1–4}. As a result, revision surgery may ultimately be required.

Effective medialization of the middle turbinate is therefore an important aspect of endoscopic sinus surgery. In order to improve operative access to the middle meatus, the middle turbinate is commonly medialized at the outset of the surgical procedure. The standard method of medialization relies on micro-fracturing or “green-sticking” the turbinate bone with a Freer elevator or similar instrument. Incomplete release and tissue memory, however, may prevent maximal medialization of the turbinate to its ideal position abutting the nasal septum. Furthermore, this maneuver may result in an uncontrolled and unfavorable fracture pattern, potentially destabilizing the middle turbinate or even injuring the skull base.

The basal lamella relaxing incision (BLRI) is a novel technique of middle turbinate medialization that is designed to maximize the distance between the middle turbinate and lateral nasal wall, and thus the working area within the middle meatus. The BLRI creates a controlled separation of the sagittal segment of the middle turbinate from the coronal segment of the middle turbinate (the basal lamella), thereby releasing the attachment of the middle turbinate to the lateral nasal wall. The proposed potential benefits of increasing the operative area within the middle meatus at the outset of surgery are prevention of unnecessary surgical trauma to the turbinate mucosa. This may decrease the likelihood of post-operative scarring and subsequent related complications. The purpose of this study is to describe this technique and establish whether BLRI significantly enlarges the middle meatal area as compared to the native turbinate position and to standard Freer medialization.

Technique

A controlled BLRI is performed as the first step in the endoscopic approach to the middle meatus. Under direct endoscopic visualization, the middle turbinate is gently medialized to reveal the basal lamella, visible immediately posterior to the medial border of the bulla ethmoidalis. A vertical incision is made at the medial aspect of the basal lamella using the sharp end of the Freer elevator. (Fig. 1) The incision is made through all layers of the basal lamella at the transition between the sagittal and coronal planes of the middle turbinate. An incision length of approximately 1.5–2cm is created, taking care to stay at least 1 cm above the inferior free edge of the basal lamella to avoid disruption of the branches of the sphenopalatine artery. With the tip of the Freer elevator positioned in the superior meatus, medial pressure is then exerted against the sagittal portion of the middle turbinate, dilating the incision to achieve successful turbinate medialization.

Materials and Methods

This surgical maneuver is a routine part of the all primary endoscopic sinus surgeries performed by the authors. The institution’s standard surgical consent includes a clause allowing medical information gathering in the form of intra operative photography. As all images were de-identified, the study was determined by the Stanford University Research Compliance office to meet the criteria for exemption from IRB review.

Twenty-nine middle turbinate medializations were prospectively evaluated in 18 consecutive patients undergoing primary endoscopic sinus surgery (11 bilateral; 7 unilateral). Patients undergoing revision sinus surgery were excluded. Fourteen right and 15 left turbinates were measured. Preoperative diagnosis was chronic rhinosinusitis (CRS) in 15 patients (25 turbinates), Grave's ophthalmopathy in one patient (2 turbinates), frontal osteoma in one patient (1 turbinate) and pterygomaxillary fossa lesion in one patient (1 turbinate). There were 10 male (17 turbinates) and 8 female (12 turbinates) patients. All patients were over 18 years of age. All surgeries were performed by the authors.

After decongestion of the nasal cavity and middle meatus with 1:1000 epinephrine-soaked cotton pledgets, the root of the middle turbinate was injected with 2cc of 1% lidocaine with 1:100,000 epinephrine. An initial endoscopic image of the middle turbinate in its native position was acquired. Standard middle turbinate medialization was first performed using a Freer elevator. The elevator was advanced along the lateral surface of the turbinate toward the basal lamella and firm medial pressure was applied. The elevator was removed and image of the medialized turbinate was obtained.

Next a controlled BLRI was then made with a Freer elevator. The elevator was removed and a final image was obtained following completion of the BLRI. All images were recorded without identifying information.

The middle meatal photos were then analyzed in a blinded and randomized fashion to calculate the distance from the middle turbinate to the lateral nasal wall. Calculations were made for each of the three scenarios: 1) Native position (Fig. 2) 2) Standard Freer Medialization (Fig. 3) 3) Basal Lamella Relaxing Incision (Fig. 3). In order to standardize the measurement location for each turbinate, a tangential line (line A) was drawn from the apex of the root of the middle turbinate to the lateral most point of the free edge of the turbinate. A perpendicular line (line B) through line A was then drawn from the tangent to the maxillary line. Line B was measured in millimeters and recorded for each of the three images (Fig. 3).

Since data for the Native and Standard Freer groups did not fulfill the normality assumption, the Friedman's ANOVA was used to identify any significant difference between the three measurements. The Wilcoxon signed-ranks test was used for post hoc analysis to identify specific differences between pairs of measurements. The Mann-Whitney U test was used to determine any difference in the measurements between males and females, right and left turbinate, and inflammatory (chronic rhinosinusitis) versus non-inflammatory diagnosis. All statistical analyses were performed using the PASW software version 18.0. Two tailed tests of significance were used, and significance was established at the $p < 0.05$ level. Alpha level for Wilcoxon Signed Ranks tests were adjusted per number of comparisons ($0.05/3 = 0.017$). The 95% Confidence Intervals (95% CI) for the medians were calculated in Minitab® Statistical Software.

Results

The study population consisted of 29 patients undergoing primary endoscopic sinus surgery. Seventeen of the study patients were males (59%) and 12 were females (41%). There was an equal distribution between left-sided ($n=15$, 52%) and right-sided ($n=14$, 48%) procedures. The majority of the patients had a diagnosis of CRS ($n=25$, 86%).

Distances measured for each procedure ranged from 0 to 8 mm (median = 3.00 mm) for the native position, 0.5 to 10 mm (median = 5.00 mm) for Standard Freer medialization, and 3 to 21 mm (median = 10.00 mm) for BLRI.

Friedman's ANOVA showed that there was significant difference between the three measurements (Figure 4), and the post-hoc Wilcoxon signed-ranks tests showed that BLRI distance [median=10, 95% CI (7 to 11.2)] was significantly larger than both Standard Freer [median=5, 95% CI (4 to 6.2)] and Native [median=3, 95% CI (2 to 3)] and that Standard Freer was significantly larger than Native (all p-values <0.001).

No significant difference was found in the extent of medialization when comparing left to right side (Native p = 0.621; Freer p = 0.780; BLRI p = 0.331), male to female (Native p = 0.616; Freer p = 0.948; BLRI p = 0.948), or inflammatory (chronic rhinosinusitis) versus non-inflammatory diagnosis (Native p = 0.124; Freer p = 0.444; BLRI p = 0.647).

There were no CSF leaks, epistaxis, or any other complications resulting from any of the medialization procedures.

Discussion

Safe and effective medialization of the middle turbinate is an important first step towards successful execution of endoscopic sinus surgery. Medialization of the turbinate without a relaxing incision can lead to green-sticking of the turbinate bone, which can limit the amount of middle meatal exposure gained. Furthermore, green-sticking of the turbinate bone can result in turbinate re-lateralization post-operatively. On the other hand, overzealous medialization can result in uncontrolled microfractures of the middle turbinate bone, which may destabilize the turbinate, or potentially place the skull base at risk.

A relaxing incision of the basal lamella is a controlled technique that offers an attractive alternative to standard techniques of middle turbinate medialization. By separating the coronal portion of the middle turbinate basal lamella from the sagittal portion of the middle turbinate, the BLRI releases the primary attachment of the middle turbinate to the lateral nasal wall. Turbinate medialization is thereby optimized. BLRI is completed at the start of endoscopic sinus surgery before any tissue dissection has been performed.

For patients undergoing posterior ethmoidectomy, BLRI also establishes a safe inferomedial entry point into the superior meatus and posterior ethmoid sinus after the anterior ethmoidectomy has been completed. This entry point is inferior to the roof of the maxillary sinus and thus comfortably distant from the skull base—a point of particular importance in patients with a short posterior ethmoid height or down-sloping skull base.

Various publications have addressed prevention of turbinate lateralization. Strategies include purposeful abrasion of the medial mucosa of the middle turbinate and nasal septum to encourage medially-directed scar formation;^{5,6} suture medialization of the middle turbinates to the nasal septum⁷⁻⁹; middle turbinate to nasal septal clip insertion;¹⁰ and the temporary insertion of middle meatal spacers of varying materials^{11, 12}. In our experience, the routine use of BLRI diminished destabilization of the middle turbinate and the need for these adjunctive techniques, although this endpoint was not specifically analyzed. An interesting future study would be to determine the effect of BLRI as compared to standard Freer medialization on post-operative healing and turbinate lateralization.

Conclusion

BLRI is a safe, controlled technique that provides significantly greater medialization of the middle turbinate compared to standard medialization techniques. BLRI significantly enhances the operative space within the middle meatus at the outset of surgery.

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Figure 1.
(Top) Incision site (dotted line) at junction between sagittal and coronal planes of basal lamella (BL); (Bottom) Freer elevator through basal lamella (BL) relaxing incision; Bulla ethmoidalis=BE

Figure 2.
Native position of middle turbinate

Figure 3. Middle turbinate after Freer elevator medialization. Line A is the tangential line from the apex of the root of the middle turbinate to the lateral most point of the free edge of the turbinate. Line B is the perpendicular line from the tangent on line A to the maxillary line.

Figure 4.
Middle turbinate after Basal Lamella Relaxing Incision (BLRI).

Figure 5.
Distribution of distance measured for each of the methods used on 29 patients.

Table 1

Description of study population (n=29) CRS=chronic rhinosininitis, GO=Grave's Ophthalmopathy, FO=frontal osteoma, PMFL=pterygomaxillary fossa lesion.

Characteristic	N(%)
Gender	
Male	17 (59)
Female	12 (41)
Side of procedure	
Left	15 (52)
Right	14 (48)
Diagnosis	
CRS	25 (87)
FO	1 (3)
GO	2 (7)
PMFL	1 (3)