

# Middle Turbinate Resection: Issues and Controversies

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## ABSTRACT

*Diversity of opinion continues to exist among otolaryngologists regarding the potential benefits of preservation or resection of the middle turbinate during endoscopic ethmoidectomy. Rhinologists in favor of middle turbinate preservation cite the potential loss of olfactory function as well as diminished humidification and filtration of inspired air following its resection. In addition, the middle turbinate remnant could lateralize, causing frontal recess obstruction and frontal sinusitis. In general, it is accepted that a diseased or flail middle turbinate should be resected during ethmoidectomy to create a marsupialized surgical bed. However, in the case of a structurally sound middle turbinate, indications for resection vary significantly. We are reporting on 100 primary endoscopic ethmoidectomies for chronic rhinosinusitis followed for at least 2 years. Of these 100 sides, 50 included conservative partial middle turbinectomy and 50 were performed with middle turbinate preservation. The postoperative clinical and endoscopic findings revealed no difference in the incidence of frontal sinusitis or frontal recess stenosis between groups. We compared additional data and present our technique of conservative middle turbinate resection, which preserves a portion of this structure as an important anatomic landmark. (American Journal of Rhinology 14, 193–197, 2000)*

**R**esection of the middle turbinate (MT) during endoscopic ethmoidectomy is a controversial procedure that has received significant attention in the recent literature. Many rhinologists agree that a diseased, destabilized, or

obstructing MT should be partially resected. However, the potential benefit of partial MT resection in the absence of these indications is not as clear. Those who advocate partial MT resection report their observations of decreased incidence of both synechia formation and postoperative lateralization of the middle turbinate, higher long-term patency rates of the middle meatal antrostomy,<sup>1,2</sup> improved nasal airflow, and decreased nasal resistance.<sup>3</sup> They also suggest that access to the ethmoid labyrinth is improved both intraoperatively and postoperatively.<sup>4</sup>

Those authors in favor of MT preservation question the liberal use of MT resection, particularly for purposes of access. The arguments against MT resection relate primarily to the loss of an important anatomic landmark as well as the potential alteration of nasal function, development of atrophic rhinitis, promotion of frontal sinusitis, and hyposmia.<sup>5</sup>

Aggressive resection of the MT may result in stenosis of the frontal recess. This occurrence would be a major factor contributing to symptomatic frontal sinusitis. We initiated this retrospective study to evaluate the effect of middle turbinate resection (MTR) on patency of the frontal recess and the development of symptomatic frontal sinusitis in a population of patients undergoing primary endoscopic sinus surgery with and without conservative partial MTR.

## MATERIALS AND METHODS

**W**e conducted a retrospective review of a select patient population with chronic rhinosinusitis who underwent primary endoscopic ethmoidectomy at New York University Medical Center. Patients with frontal headaches and anatomic obstruction of the frontal sinus outflow tract necessitating endoscopic dissection within the frontal recess were excluded. For all patients, each surgical side was evaluated independently and the sides were divided into two groups based on the management of the middle turbinate: resection (MTR), and preservation (MTP).

Thirty-nine patients underwent partial MTR on 50 sides (11 bilateral). There were 20 male and 19 female patients in this group, who ranged in age from 16 to 71 years (mean

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43). Indications for MTR included disease involving the turbinate (19), concha bullosa (4), flail turbinate (14), or obstruction of access to the middle meatus (13). Thirty-two patients underwent surgery with MTP on 50 sides (18 bilateral). This group consisted of 17 male and 15 female patients from 15 to 67 years of age (mean 41).

All patients had a preoperative CT scan of the paranasal sinuses that demonstrated mucosal disease; the surgical procedure was determined by the extent and location of disease. All patients had anterior ethmoid disease and underwent anterior ethmoidectomy; 23 patients had posterior ethmoid surgery (Table I). Additional procedures (SMR, inferior turbinoplasty) were performed as indicated by the patients' symptoms and physical findings.

We used a technique of partial MTR that removes the anterior/inferior one-third to one-half of the turbinate, preserving the superior and lateral attachments (Figs. 1 and 2). After injecting the middle turbinate with 1% lidocaine with 1:100,000 epinephrine (Fig. 3), the turbinate is gently crushed with a curved mosquito clamp along the expected line of resection. A curved endoscopic scissor is then used to resect the turbinate through the crushed zone.

Patients were followed for a minimum of 2 years after surgery. All patients were routinely evaluated with fiberoptic nasal endoscopy in the office at each postoperative visit. Findings of mucosal disease within the ethmoid cavity, synechiae, lateralization of the middle turbinate, and stenosis of the antrostomy and frontal recess were noted and recorded. Endoscopic examination of the frontal recess was used to determine its patency. Patients were questioned regarding symptoms of acute sinusitis, and the number of episodes of frontal sinusitis were tabulated. Frontal sinusitis was defined as an acute episode with clinical findings and symptoms, including frontal headaches, consistent with frontal sinusitis.

## RESULTS

In the MTR group, there were no cases of lateralization of the middle turbinate remnant obscuring endoscopic visualization of the frontal recess. Two surgical sides devel-

oped non-obstructing synechiae from the turbinate remnant to the lateral nasal wall, and in an additional two sides there was symptomatic narrowing of the middle meatus antrostomy. Thirty-three sides (66%) had endoscopic evidence of recurrent mucosal disease within the anterior ethmoidectomy cavity or frontal recess. None of the patients developed symptoms of frontal sinusitis on the side that underwent MTR.

In the MTP group there were three cases of middle turbinate lateralization that obscured visualization of the middle meatus and frontal recess. Four sides developed non-obstructing synechiae from the anterior tip of the middle turbinate to the lateral nasal wall. On three sides there was symptomatic narrowing of the middle meatus antrostomy. Twenty-two sides (44%) had endoscopic evidence of recurrent mucosal disease within the anterior ethmoidectomy cavity or frontal recess. Two patients developed symptoms of frontal sinusitis localizable to the side of MTP, and had mucosal disease within the frontal recess (Table II).

## DISCUSSION

The MT is embryologically derived from the ethmoid bone. Structurally, the MT can be divided into three segments.<sup>6</sup> The anterior third attaches vertically to the skull base just lateral to the cribriform plate. The middle segment, the ground or basal lamella, turns laterally, attaching to the orbital plate of the ethmoid bone (lamina papyracea) and divides the ethmoid sinus into an anterior and a posterior group of cells. The posterior segment of the MT is oriented horizontally and inserts onto the perpendicular process of the palatine bone.<sup>6</sup> The anterior/superior portion of the MT, an important surgical landmark, forms the medial boundary of the frontal recess.<sup>7</sup> Therefore, lateralization of the MT can lead to structural narrowing of the frontal sinus outflow tract and frontal sinusitis.

The effect of middle turbinate resection on normal sinus and nasal physiology remains uncertain. The nasal turbinates are thought to function collectively to direct and assist in lamination of nasal airflow, humidify and warm inspired air, and provide a mechanical defense against particulate matter. As compared to the inferior turbinate, the MT is significantly smaller, contains less vascular and erectile tissue, accounts for a negligible portion of nasal airway resistance, and is believed to have less functional significance.<sup>1</sup> Despite this evidence, as well as literature supporting the safety of middle turbinectomy, the procedure continues to provoke a considerable amount of controversy, particularly regarding lateralization of the turbinate remnant as a factor promoting postoperative frontal sinusitis. Other concerns include loss of a significant surgical landmark, development of atrophic rhinitis, and hyposmia.

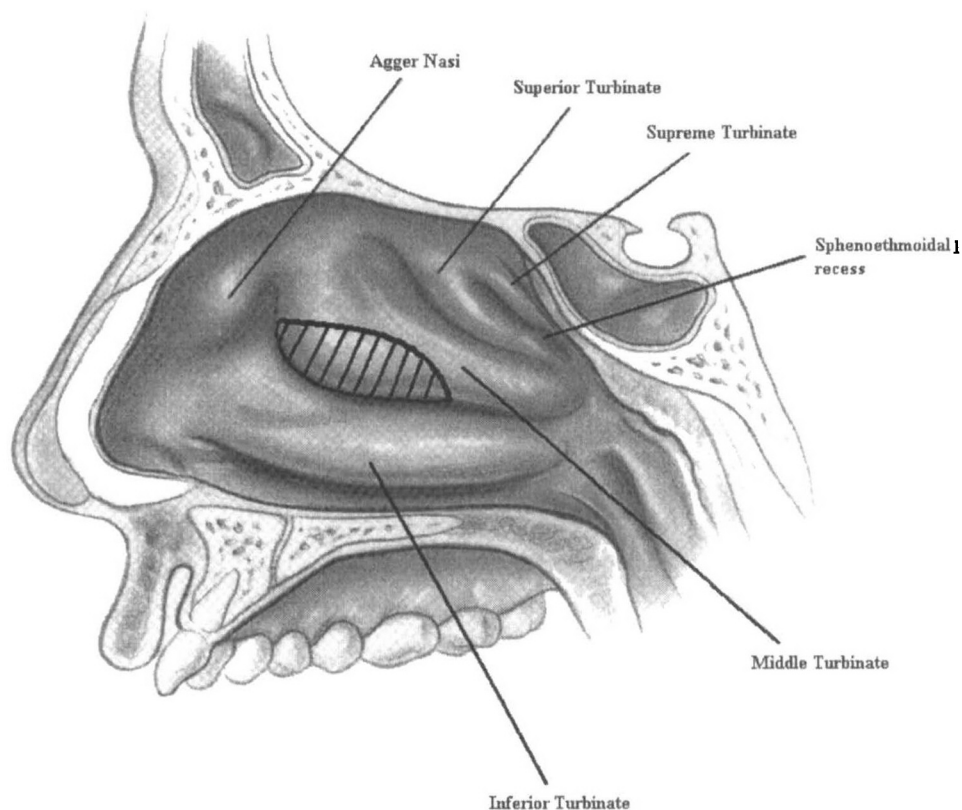
Yankauer described the complete sphenoethmoidectomy operation with removal of the MT.<sup>8</sup> However, because of concerns about atrophic rhinitis and other complications generally associated with overzealous resection of the inferior turbinate, surgeons remained wary of MT resection. In

TABLE I

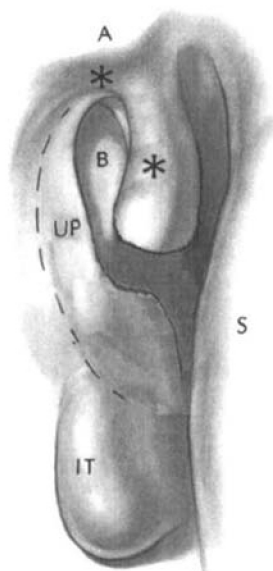
### Distribution of Sinus Disease Based on Preoperative CT Imaging

	MTR Group	MTP Group
Frontal sinus	36/50 (72%)	22/50 (44%)
Anterior ethmoid sinus	50/50 (100%)	50/50 (100%)
Posterior ethmoid sinus	37/50 (74%)	23/50 (46%)
Sphenoid sinus	13/50 (26%)	8/50 (16%)
Maxillary sinus	41/50 (82%)	37/50 (74%)

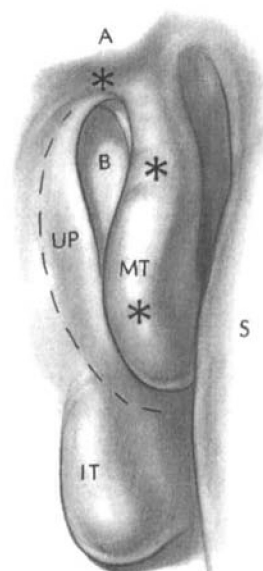
MTR = middle turbinate resection; MTP = middle turbinate preservation.



**Figure 1.** Resected portion of the middle turbinate.



**Figure 2.** Endoscopic view after turbinate resection.



**Figure 3.** Injection sites on the middle turbinate.

1980, Morgenstein and Krieger reported their experience with 36 patients who underwent middle turbinectomy for symptoms of headache and nasal obstruction.<sup>9</sup> There were no complications and none of the patients developed atrophic rhinitis.

More recently, Lawson reported 1077 intranasal ethmoid-

ectomies in which a partial middle turbinectomy was performed with preservation of the superior half of the turbinate.<sup>10</sup> He concluded that partial middle turbinectomy provided maximal surgical access to the middle meatus, permitted easy postoperative debridement of the sinus cavities, and minimized the incidence of synechiae formation.

TABLE II

Postoperative Endoscopic and Clinical Findings		
	MTR Group	MTP Group
Turbinate lateralized	0/50 (0%)	3/50 (6%)
Synechiae	2/50 (4%)	4/50 (8%)
Antrostomy stenosis	2/50 (4%)	3/50 (6%)
Recurrent mucosal disease	33/50 (66%)	22/50 (44%)
Frontal sinusitis	0/50 (0%)	2/50 (4%)

*MTR = middle turbinate resection; MTP = middle turbinate preservation.*

There were no instances of atrophic rhinitis. He found the MT to be an important anatomic landmark and noted that complete absence of this structure was associated with an increased incidence of complications.

Lateralization of the middle turbinate and synechiae formation are common causes of postoperative closure of the middle meatal antrostomy. Davis et al. and LaMear et al. concluded that partial middle turbinectomy was the most important variable in predicting long-term patency of the antrostomy.<sup>1,2</sup> They attributed their low rate of synechiae formation and increased antrostomy patency rate to the "liberal use of middle turbinectomy." LaMear et al. describe three factors that may explain the lack of significant complications previously believed to be associated with middle turbinate resection: the middle turbinate has less functional significance than the inferior turbinate; the middle turbinate is only partially removed, preserving its superior attachment, and therefore its importance as a surgical landmark; only a small area of the turbinate is denuded, and this has been shown to be replaced with normal respiratory epithelium.<sup>1</sup>

Swanson et al. reported a series of patients with persistent rhinosinusitis following endoscopic sinus surgery (ESS). Among patients with mild to moderate disease, frontal sinus mucosal thickening was observed in 30 sides (75%) following middle turbinate resection, and only 9 sides (45%) that did not include MT resection.<sup>5</sup> They also add that middle turbinectomy may contribute to anosmia postoperatively or premature anosmia with age. The authors discuss potential weaknesses of this retrospective study, including a small sample size that includes only patients with persistent symptoms, and a lack of preoperative data on the condition of the frontal sinuses. They state that these limitations "make it difficult to draw firm conclusions."

Subsequently, three studies have been published that address the issues of frontal sinusitis and anosmia following MTR. Saidi et al. evaluated 32 patients (56 sides) who had undergone endoscopic ethmoidectomy with partial MTR. All patients were studied with postoperative MRI scans and only six frontal sinuses (11%) demonstrated minimal mucosal thickening (grade I), which had not been apparent on

preoperative CT imaging.<sup>11</sup> Fortune and Duncavage retrospectively reviewed 100 patients (163 sides) who underwent partial MT resection with ESS and observed a 10% incidence of postoperative frontal sinusitis, defined as >6 mm of mucoperiosteal thickening or an air-fluid level on postoperative CT scanning, pus emanating from the frontal ostium, or culture-proven infection with material obtained from the frontal sinus. This occurred primarily in patients with associated comorbid factors such as asthma, nasal polyps, severe disease grading, or diseased middle turbinates.<sup>12</sup> Friedman et al. prospectively evaluated olfaction in 64 patients undergoing ESS using the University of Pennsylvania Smell Identification Test (UPSIT) given preoperatively and 8 weeks postoperatively.<sup>13</sup> There was no statistical difference in olfaction among the 38 patients who underwent MT resection and 26 in whom the middle turbinate was preserved.

The objective of our study was to evaluate the effect of conservative MTR on the anatomic and functional patency of the frontal recess. Patients with preoperative symptoms of chronic frontal sinusitis and obstruction of the frontal sinus outflow tract requiring endoscopic frontal sinusotomy were purposefully excluded. However, mucosal thickening within the frontal sinus was not itself a criterion of exclusion; 72% of the MTR group and 44% of the MTP group demonstrated this preoperative finding. Therefore, the occurrence of symptomatic frontal sinusitis in this group of patients may be more directly related to the surgery performed than to persistent mucosal disease.

Endoscopic office examination alone was used to determine patency of the frontal recess and the presence of mucosal edema within the ethmoid cavity. Mucosal edema within the frontal sinus itself could not be reliably determined in this manner, and postoperative imaging was not utilized to evaluate these patients without any symptoms of frontal sinusitis.

Postoperative endoscopy revealed a significant incidence of persistent mucosal disease within the ethmoid cavity in all patients, irrespective of management of the MT. The presence of mucosal hypertrophy without symptomatology has been reported to occur with relative frequency.<sup>7,14</sup> We feel that this finding alone, without any symptoms of recurrent sinus disease, is not an indication for treatment and certainly does not require diagnostic imaging. It may be inferred that this endoscopic finding does not significantly interfere with ventilation or mucociliary clearance. Lateralization of the MT or MT remnant was felt to be more significant than mucosal hypertrophy, as it represents a fixed obstruction to frontal sinus ventilation and drainage.

Other techniques to prevent lateralization of the middle turbinate and synechiae formation have also been described. These include creating controlled synechiae between the septum and the middle turbinate, placing splints in the middle meatus, or suture stabilization to the septum.<sup>15-17</sup> However, these techniques do not adequately address ob-

structing or diseased middle turbinates that may be contributing to the disease process.<sup>18</sup> Evaluation of middle meatus antrostomy stenosis in this study failed to demonstrate any significant benefit of MTR. Ease of surgical and postoperative access to the middle meatus cannot be objectively measured; however, it is the authors' feeling that in the MTR group visualization and access to the ethmoid cavity was enhanced.

We recognize certain limitations of this study, including the preoperative selection bias inherent in a retrospective study. Since MTR was most often performed in cases of a diseased or destabilized middle turbinate, this group could be expected to have more significant preoperative disease. However, radiologic staging was not done preoperatively and the presence or absence of this bias cannot be determined. The power of the study is also limited by the relatively small sample size being used to evaluate a postoperative complication that occurs infrequently.

## CONCLUSION

**I**n this study group conservative middle turbinate resection was not associated with an increased incidence of frontal recess stenosis and secondary frontal sinusitis. While we do not support the routine use of MTR, it was not associated with an increased incidence of unfavorable outcomes. With this understanding, the appropriateness of partial MTR to enhance surgical access to the middle meatus, during ESS and for postoperative debridement, should be determined by the surgeon on a case-by-case basis.

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