

Power Microdebrider-Assisted Modification of Endoscopic Inferior Turbinoplasty: A Preliminary Report

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Background: In this article, microdebrider-assisted modification of endoscopic inferior turbinoplasty is described. It has the advantage of superior visualization during elevation of the mucosal flap and allows precise tailoring of the resection to the needs of patients.

Methods: From November 2001 to December 2002, 29 patients with chronic hypertrophic rhinitis treated with power endoscopic inferior turbinoplasty were available for follow-up examinations. Questionnaires and rhinomanometric studies were performed for subjective and objective evaluations. These patients were followed up for an average of 15.3 months after the operation.

Results: The overall improvement in nasal obstruction was 91% in our study. Twenty-two patients received rhinomanometric studies 1 week preoperatively and 2 months postoperatively. The average nasal airflow was increased by 187 ml/min. In addition, complete relief of headaches was achieved. But the remission rates of persistent rhinorrhea and post-nasal dripping were less significant, at about 58% and 54%, respectively. Atrophic change and permanent synechiae had not yet been observed.

Conclusions: Power endoscopic turbintoplasty is a safe, simple, and effective method for the treatment of chronic hypertrophic rhinitis. It is especially handy in adjunct to endoscopic septoplasty or sinusurgery, and appears to provide a surgical choice of a minimally invasive technique. However, further study with a prospective design is needed to strengthen the evidence.

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Key words: microdebrider, endoscopic, turbinoplasty.

Most turbinate resection techniques involve treatment of the submucosal erectile tissue, with sacrifice of the mucosa for greater access to the target area. However, sacrificing too much mucosa has been reported to increase the risk of dryness throat, nasal crusting, nasal bleeding, and extremely patent nasal cavities.⁽¹⁾ Therefore, the main goal of surgical reduction of the inferior turbinates is to

relieve the obstruction while preserving the function of the turbinates.⁽²⁾ In this article, a microdebrider-assisted endoscopic partial turbinectomy is described as a modification of inferior turbinoplasty. This procedure combines conservative sparing of the nasal mucosa offered by submucous resection with adequate removal of the obstructing tissue characteristic of partial turbinate resection.

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METHODS

Our study group consisted of 29 consecutive patients undergoing endoscopic partial inferior turbinoplasty with microdebrider-assistance between November 2001 and December 2002. All patients were free of a history of previous nasal surgery and of concurrent upper respiratory tract infection. Ages of the patients ranged from 18 to 71 (mean, 41.3) years. Thirteen patients were male, and 16 were female (for a male: female ratio of 1: 1.2). All 29 patients had pathologically proved hypertrophied inferior turbinates and were enrolled in our study. They were further classified into 3 groups according to the operation method they underwent. Group A consisted of 10 patients who received inferior turbinoplasty only. Group B consisted of 5 patients who received functional endoscopic sinusurgery (FESS) along with inferior turbinoplasty. Group C consisted of 14 patients who received submucosal resection (SMR) of the septal cartilage along with inferior turbinoplasty (Table 1). The average length of follow-up was 15.3 (range, 6-15) months[something is wrong with the numbers; the average is outside of the range.]. Table 2 outlines the symptom complexes presented by the 29 patients who eventually underwent surgical correction for the hypertrophied inferior turbinates.

Anterior rhinomanometry (Rhinomanometer 300, ATMOS Medizintechnik, Germany) was applied both 1 week preoperatively and 2 months postoperatively. Complete healing of the nasal wound was observed 2 months after the procedure. The nasal crust or rhinorrhea was thoroughly removed before the rhinomanometric study. Setting a

pressure level of 150 Pa, we measured the nasal air-flow amount of 22 patients before and after the operation. These data provided objective analysis for further comparison.

In addition, another 22 patients were selected for our control group, including 16 males and 6 females (for a male: female ratio of 2.67: 1). Ages of the patients ranged from 24 to 57 (mean, 38.7) years. They received the same evaluation as those of the study group, including a questionnaire and rhinomanometric survey.

Surgical technique

After adequate anesthesia was administered, the patient was positioned and draped for endoscopic nasal surgery. The inferior turbinates were usually addressed after other major nasal surgery had been completed. Visualization throughout the procedure was accomplished using a straightforward, 4-mm-diameter, 0° nasal endoscope (Hopkins II, no. 7210AA, Karl Storz, Germany). Both of the inferior turbinates were injected with 2-3 ml of local anesthesia containing 1% lidocaine with 1: 2000 epinephrine. Injections were performed along the inferior and medial edges of the turbinate, blanching the turbinal mucosa. An incision was made with pouch forceps in a vertical manner at the anterior pole of the inferior turbinate. A submucosal pocket was created with sharp dissection on the medial side of the bony turbinate. The straight microdebrider (XOMED Medtronic, USA) (3.5-mm tip with a serrated blade,

Table 1. Clinical Summary of Patients

	Case	
	No. of patients	Percentages
Gender		
Male	13	45%
Female	16	55%
Classification according to the operative method		
Turbinoplasty	10	34%
FESS with turbinoplasty	5	17%
SMR with turbinoplasty	14	49%

Abbreviations: FESS: functional endoscopic sinusurgery; SMR: submucosal resection.

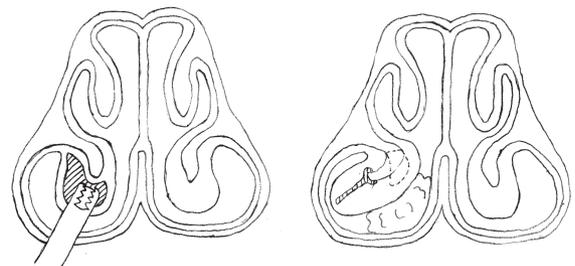


Fig. 1 After cutting on the anterior pole of the inferior turbinate, an intratubinal pocket is made through to the posterior end. Then, a microdebrider is used to remove redundant erectile tissue inside the pocket (right side). When all procedures are completed, the residual bone is outfractured and the mucosal flap is folded to the lateral side. Only a small piece of nasal packing was required for further hemostasis (left side).

no. 18-83502) was applied through the pocket, and was used to grasp the erectile tissue and pull it into the hollow shaft. After fully removing the erectile tissue, endoscopic scissors were used to resect the turbinate bone while preserving both the medial and lateral mucosal surfaces. Finally, the residual bone was outfractured, and the mucosal flap was folded over the bone edge (Fig. 1).

Size reduction of the inferior turbinate was easily recognized immediately after the procedure. Nasal sponges were left in place to stent the mucosal flap. The packing was removed 4 days later, and patients were then discharged from the hospital for further clinical follow-up.

RESULTS

Outcomes were measured with a questionnaire based on information addressing both the preoperative and postoperative status of the nasal airway of patients (Table 2). The overall success rates of relieving nasal obstruction and frontal headaches were 91% (20/22) and 100% (10/10), respectively. Although 2 patients complained of no improvement in nasal patency, none of our patient reported wors-

ened nasal obstruction after the operation. However, some patients had difficulty retrospectively recalling their preoperative nasal patency. Symptoms of rhinorrhea and postnasal discharge were not completely relieved in many patients after the operation, with only 58% (7/12) and 54% (7/13), respectively, of those patients attaining satisfactory outcomes.

Twenty-two patients received both preoperative and postoperative anterior rhinomanometry (Rhinomanometer 300) for objective analysis. According to our previous classification, they were divided into group A with 7 patients, group B with 4 patients, and group C with 11 patients. Their nasal airflow measurements are listed in Table 3. Our data revealed an approximate improvement of 237 ml/min in nasal airflow (from 197 ± 74 to 434 ± 104 ml/min, $p < 0.05$) in group A, of 163 ml/min (from 230 ± 65 to 393 ± 61 ml/min, $p < 0.05$) in group B, and of 164 ml/min (from 225 ± 50 to 389 ± 60 ml/min, $p < 0.05$) in group C. The average improvement was 187 ml/min (from 217 ± 67 to 404 ± 97 ml/min, $p < 0.05$) in these 22 patients, corresponding with their increased nasal patency. The between-group differences proved to be insignificant (using a one-way

Table 2. Symptom Complexes of the 29 Patients Treated by Inferior Turbinoplasty

	Preoperatively		Postoperatively (2 months)		Improvement ratio	McNemar's test
	No. of patients	Percentages	No. of patients	Percentages		
Nasal obstruction	22	75%	2	7%	91%	$p < 0.05$
Headaches	10	34%	0	0%	100%	$p < 0.05$
Post-nasal drip	12	41%	5	17%	58%	$p < 0.05$
Rhinorrhea	13	45%	6	21%	54%	$p < 0.05$
Hyponosmia	3	10%	1	3%	67%	$p > 0.05$

Table 3. Measurements of Airflow (ml/min) at 150 Pa

	Preoperatively		Postoperatively (2 months)		Paired <i>t</i> -test
	No.	Mean	No.	Mean	
Control	22	374 ± 76	22	374 ± 76	
Turbinoplasty (Group A)	7	197 ± 74	7	434 ± 104	$p < 0.05$
FESS with turbinoplasty (Group B)	4	230 ± 65	4	393 ± 61	$p < 0.05$
SMR with turbinoplasty (Group C)	11	225 ± 50	11	389 ± 60	$p < 0.05$
Average	22	217 ± 67	22	404 ± 97	$p < 0.05$

Abbreviations: FESS; functional endoscopic sinusurgery; SMR: submucosal resection.

* We used a Rhinomanometer 300, made by ATMOS Medizintechnik, Germany. The upper limit of the test value is 1000 ml/min; those above the upper limit were recorded as 1000 ml/min. However, none reached the upper limit in our study.

† The between-group differences were below the significance level both preoperatively and postoperatively (by one-way ANOVA).

ANOVA test) both preoperatively and postoperatively.

The nasal airflow in our control group was 374 ± 76 ml/min. There was also notable airflow augmentation after application of a topical decongestant, showing that the nasal turbinate mucosa still retained its vasoactive function.

Brisk intraoperative bleeding was not a problem with the endoscopic technique. The average blood loss during our turbinoplasty was about 10 ml. However, postoperative nasal bleeding was observed in 3 patients, all within the first 24 hours after the nasal sponges were removed. The nasal bleeding in those patients stopped after temporary packing with epinephrine-soaked gauze. None of these patients needed a posterior nasal tamponade or blood replacement.

Crusting occurred in 4 patients but was resolved with meticulous local treatment, mostly within 2 weeks postoperatively. Synechiae formation was transiently seen in 3 patients. One of them resolved spontaneously, and others resolved rapidly after simple lysis during early postoperative follow-up. The synechiae did not interfere with nasal airflow or nasolacrimal duct function.

Throat dryness was another minor complaint noted by 2 patients. Both patients also became extremely sensitive when inspiring cold air. This was probably due to over-resection of the intratubinal tissue, with insufficient turbinate left to humidify and warm the inspired air. Therefore, we found it better to slightly under-resect the intratubinal tissue, rather than to over-resect it.

DISCUSSION

Inferior turbinates serve several important functions, such as warming, humidifying, and cleansing inspired air.⁽³⁾ They contribute to inspiratory resistance, which creates intrathoracic negative pressure needed for inspiration. Greater negative pressure enhances pulmonary ventilation and venous return to the lungs and heart.⁽⁴⁾ However, they are also the main structures contributing to chronic nasal obstruction. Chronic inflammatory conditions, including allergy and chronic rhinosinusitis, result in the deposition of collagen beneath the basement membrane of the sinonasal mucosa, along with mucous gland hyperplasia and resultant hypersecretion.⁽⁵⁾ Changes

of this nature are almost irreversible. If symptomatic hypertrophy unresponsive to medical management is involved, the turbinates may still be considered surgically treatable.

Numerous techniques have been described in the literature, including chemocautery, intratubinal injection,⁽⁶⁾ outfracture, cryotherapy,^(7,8) electrocoagulation,^(7,9) and laser ablation^(10,11) to treat hypertrophied turbinates. Among these techniques, chemocautery is not recommended, because it causes massive destruction of the mucosal cilia and gland with only slight reduction of the turbinate. The use of an intratubinal injection has also been limited, because injection of steroids has been reported to cause ipsilateral blindness as a rare but major complication.⁽¹²⁾ Injection of other sclerosing agents, such as sodium morrhuate or sodium psylliate, has been reported to bring only temporary benefit.⁽¹³⁾ Therefore, the intratubinal injection technique has not been widely used.

Outfracture of the inferior turbinate was the primary mechanical procedure described by Killian in 1904. However, it is not recommended as a single procedure because of the tendency of the turbinate to spring back to its original position.⁽¹⁴⁾ Electrocautery and cryosurgery can reduce the bulk of the turbinates by inducing scarring or by direct destruction. These techniques are quite simple and can be performed under local anesthesia, but the results have been transient and unreliable.^(8,13) Laser reduction of the turbinate was first introduced by Lenz in 1977, who found argon laser surgery to be effective in treating patients with vasomotor rhinitis.⁽¹⁵⁾ The procedure is easy to perform under local anesthesia, but eschar formation and the potential for stray laser burns and synechiae are the major problems. In addition, it is ineffective at removing bone as the source of nasal obstruction.

In addition to these procedures, total turbinectomy, partial turbinectomy, submucosal resection, and inferior turbinoplasty are also well documented.^(14,16) Among these methods, Jackson and Koch⁽¹⁷⁾ commented that turbinectomy techniques appear to produce more-effective long-term results than extramucosal reduction techniques, such as linear cautery, submucosal diathermy, and cryotherapy. Courtiess and Goldwyn⁽¹⁸⁾ also pointed out that turbinate resection procedures are the only way to consistently improve the nasal airway, with statistical significance

noted for both objective rhinomanometry and subjective patient self-assessment.

Recently, power instruments like "microdebriders" and "shavers" have come into use in turbinate surgery.⁽¹⁹⁾ These instruments are used on the turbinate surface as well as intraturnally, often in combination with an endoscope. Many surgeons resect parts from the lateral and inferior borders of the turbinate, while others (including our series) use the microdebrider intraturnally.^(2,20) The latter technique has been reported to be fast, effective and well tolerated with a low morbidity rate.⁽²¹⁾

The endoscopic approach has the advantage of using the same equipment during the endoscopic sinus surgery, so it is not necessary to introduce additional equipment. The principal merit of the endoscopic technique is its excellent visualization during the entire procedure. This allows precise elevation of the mucosal flap without unguarded tearing, even at the most posterior end of the inferior turbinate. Dealing with the posterior part would be difficult with the traditional headlight procedure.

In 1983, Courtiss performed partial turbinectomy on 17 patients with hypertrophic rhinitis and achieved significant improvements in nasal airflow of up to 340 ml/min.⁽¹⁸⁾ Likewise, Cook in 1995 also attained similar improvements of up to 344 ml/min in 16 patients receiving partial turbinectomy along with functional endoscopic sinus surgery (Table 4).⁽²²⁾ These data again supported the premise that the turbinal resection procedure is very effective in treating nasal obstruction. In addition, we observed that the amount of nasal airflow in preoperative, postoperative, and control groups of those studies was all greater than ours. This is probably due to the innate

differences between Asian and Caucasian noses.

Wound healing conditions during follow-up are very good with endoscopy. There is almost no crusting in the second week postoperatively. In our cases, symptoms like nasal obstruction and headaches showed significant improvements after power endoscopic turbinoplasty (Table 2). Atrophic changes were not observed because the mucosa and its neurovascular supply were preserved. However, symptoms of rhinorrhea and postnasal discharge in most patients were not relieved postoperatively. Same observation was made by Mabry in 33% of his patients at 1 year or more after the mucosal-sparing turbinoplasty technique, probably due to excessive mucosal preservation.⁽²³⁾

In our series, the occurrence of postoperative bleeding was about 10% (3/33) and was resolved with temporary packing of a vasoconstrictive agent. Reactionary hemorrhage may be due to either dislodging of clots or inadequate excision leaving posteriorly attached mucosal tags. Secondary hemorrhage may be due to postoperative infection, which results in hyperemia and increased friability of the remaining turbinal mucosa. This problem has also been reported with similar rates by other authors.^(1,18)

The absence of permanent synechiae (although temporary synechiae existed in 3 patients), crusting, and foul odor in this series suggests that there was no interference with the normal functioning and physiology of the nasal mucosa. No atrophic changes were observed because the natural blood supply and innervations of the mucosa were well preserved. Furthermore, conchal osteonecrosis did not occur due to minimal exposure of the conchal bone.

Although the improvement in group A (who received turbinoplasty only) was greater than that in group C (who received submucosal septal resection with turbinoplasty), there were no significant differences among groups A, B, and C, either preoperatively or postoperatively. It stands to reason that the nasal airway patency would increase more after both cartilaginous and turbinal procedures, than after simply 1 procedure. However, under-correction or residual septal deviation might exist in group A.

Power endoscopic turbinoplasty is a good adjunct to septoplasty and endoscopic sinus surgery in patients with associated turbinate hypertrophy. It provides excellent outcomes in a wide variety of patients with minimal morbidity. There is significant

Table 4. Rhinomanometric Data from Other Studies

	Preoperatively		Postoperatively	
	No.	Mean	No.	Mean
Courtiss, 1983				
Control	69	500	69	500
SMR	4	350	4	525
Partial turbinectomy	17	313	10	653
Cook, 1995				
FESS w/ partial turbinectomy	16	254	16	598

FESS, functional endoscopic sinus surgery; SMR, submucosal resection.

improvement in nasal patency which lasts for a long time. One significant advantage of this procedure is the ability to preserve the entire turbinal mucosa, except for a notch in the anterior pole of the turbinate. Keeping its functional structures intact, the turbinate can remain fully normal after the procedure. In addition, because it shares the same instruments with functional endoscopic sinus surgery, it would be very convenient to complete such a procedure after the preceding sinus surgery.

The use of power instruments appears to be a matter of personal preference. It does not matter which tools are preferred; rather, it is the surgical concept that is important in reducing the bulk of the turbinate. Although the cost of the microdebrider can be prohibitive to many, it has the potential for being an effective alternative in future turbinal surgery.

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使用微形吸絞器之改良型內視鏡式下鼻甲整形術：初步報告

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背景： 在本文中，我們將介紹一種使用微型吸絞器的內視鏡下鼻甲整形術，其優點在於分離鼻黏膜瓣時能得到較優異的視野，並可針對病人的需求做出更適切的下鼻甲修剪。

方法： 從2001年11月到2002年12月之間，共有29位患有慢性肥厚性鼻炎的病人接受此等使用微形吸絞器的內視鏡手術方式，並進行術後的追蹤檢查。評估項目包括有主觀性的問卷調查及客觀性的鼻阻力檢查。這些病人的術後平均追蹤時程為15.3個月。

結果： 在本次研究中，鼻塞的整體改善率達到了91%。共有22位病人在術前一週及術後兩個月時接受鼻阻力檢查，其鼻腔通氣量平均每分鐘增加了187毫升。此外，對頭痛的症狀也達到完全的緩解。但在持續性鼻漏及鼻倒流等方面的成效則並不顯著，各只有58%及54%的改善率。至今尚未發現有萎縮性變化或永久性的沾黏產生。

結論： 對慢性肥厚性鼻炎的患者來說，使用強力器械的內視鏡式鼻甲整形術是一種安全、簡單且有效的治療方式；尤其是在合併內視鏡式的中膈或鼻竇手術時，更能感受到它的方便、易操作。此等術式提供了另一種微創切除的治療選擇，然而仍需進一步的前瞻性研究來予以佐證。

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關鍵字： 微形吸絞器，內視鏡，鼻甲整形術。