

SURGICAL MANAGEMENT OF INFERIOR TURBINATE HYPERTROPHY IN THE OFFICE: THREE MUCOSAL SPARING TECHNIQUES

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In the management of nasal obstruction, identification and treatment of inferior turbinate hypertrophy remains an important consideration for long-term improvement of nasal breathing. New technological advances have offered application of innovative surgical modalities to the management of inferior turbinate hypertrophy in the office. We describe 3 progressively more aggressive approaches to reduction of the submucosal vascular stroma of the inferior turbinates that can be performed in the office. Using radiofrequency cautery, ionized field ablation, and the powered microdebrider, these procedures are easily performed, usually successful, and have a high level of patient satisfaction. Based on an assessment of the patient's specific needs, otolaryngologists can use these techniques to improve a patient's nasal breathing without the expense or bother of a trip to the operating room.

Although it is historically overshadowed by the deviated septum, most successful surgeons realize the importance of evaluating and treating inferior turbinate hypertrophy in the patient who complains of nasal obstruction. Recently, numerous technological advances have allowed for more effective management of the inferior turbinates in the office setting with minimal morbidity to the patient and surgeon. In this presentation we will focus on these new management techniques, their advantages, and their limitations.

The inferior turbinates are intriguing structures of the lateral nasal wall that are designed specifically to cause nasal obstruction and slow movement of nasal airflow. With a stroma filled with arteriovenous channels that are regulated by the autonomic nervous system, and a bony framework that holds the structure in the middle of the inferior nasal passage, it is very effective. In the setting of the nasal cycle, with alternating expansion of the inferior turbinates, the patient is able to regulate nasal airflow from one side to the other through the day. However, in the case of partial anatomically compromised nasal passages or misregulation of the erectile tissue, this delicate balance can be disrupted and result in the complaint of nasal obstruction. Inferior turbinate hypertrophy remains an ill-defined disease process. It is often unclear how much of this hypertrophy is related to the swelling of the general nasal mucosa or is related to the inferior turbinate vasoactive tissue. There is no accepted objective process of diagnosis for this disease, and the clinician needs to rely on experience, a thorough history, and examination. On examination, it is vital to examine the patient before and after the administration of a vasoconstrictive agent to understand the contribution of the turbinate vascular structures to the patient's nasal obstruction. It is important to

simultaneously review the patient's sense of nasal obstruction and its change with the application of this medication. Because many patients do not have a reference point to compare their present nasal breathing, they are unable to report the degree of obstruction that they feel. The vasoconstricted nose may act as such a reference for them. If dramatic objective and subjective improvement results with the use of the vasoconstrictive spray, the patient will likely benefit significantly from inferior turbinate surgery. In certain cases, the bony framework of the turbinate may contribute to obstruction by holding the turbinate medially beyond the midpoint of the airway or, because of bony hypertrophy, add to the bulk of the turbinate. These patients may significantly benefit from concurrent outfracture of the turbinate bone. Patients with mild to moderate septal deviation who do not want to undergo the morbidity of a septal procedure are also good candidates, but their improvement is limited by the degree of their bony anatomic obstruction. A trial of medical therapy is indicated for all of these patients before surgical intervention is considered.

Inferior turbinate surgery has been performed by using a wide variety of techniques, strategies of partial or subtotal turbinate excision, and mucosal and stroma ablation.¹⁻³ Most are effective in improving the nasal airway, but the structures remaining after some procedures may not be able to continue to regulate airflow in any significant way. In addition, the morbidity in terms of bleeding, crusting, and pain vary considerably. We present 3 surgical approaches to inferior turbinate management designed as office procedures with progressive degrees of intervention, but each with the goal of mucosal preservation. Although they require special equipment, all 3 allow office management of significant turbinate hypertrophy with minimal complications and a favorable postoperative course.

RADIOFREQUENCY VOLUMETRIC TISSUE REDUCTION OF THE INFERIOR TURBINATES FOR THE TREATMENT OF NASAL OBSTRUCTION

Method performed by Todd T. Kingdom, MD, FACS

Radiofrequency volumetric tissue reduction (RFVTR) is a surgical procedure that uses radiofrequency (RF) heating

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to induce submucosal tissue destruction, leading to the reduction of tissue volume. This technology has been used successfully in neurosurgery, cardiology, urology, and oncology. The application of RF in the upper airway was first shown in an in vivo porcine animal tongue model.⁴ Since its introduction, RF has been shown to be safe and effective in tissue volume reduction of the human palate for snoring and upper airway resistance syndrome,⁵ the inferior turbinates for nasal reduction,⁶⁻⁸ and the base of tongue for obstructive sleep apnea.⁹

Procedure

The equipment used includes the RF generator (Somnus Medical Technologies Inc, Sunnyvale, CA) connected to a specialized, single-use delivery tip and handpiece. The tip is a 22-gauge electrode, 4 cm in length. The active portion is 1 cm, and the remaining 3 cm is insulated. Two thermocouples allow constant temperature feedback at the location of treatment and in surrounding tissue, limiting potential injury to mucosa (Fig 1A). A grounding pad is applied to the patient's flank to return the RF current back to the generator. The nasal cavity is sprayed with 10% pontocaine followed by injection of 2 to 3 mL of 1% lidocaine into the anterior half of the inferior turbinate. I prefer not to use any vasoconstrictive agents to avoid tissue shrinkage, which could increase the risk of mucosal injury and complications. Under direct visualization, the RF electrode is placed in the anterior-inferior portion of the turbinate with several millimeters of the inactive portion in contact with the mucosa to prevent mucosal injury (Fig 1B). The RF energy is delivered (456 kHz) at a maximum of 10 W, at a maximum temperature of 75°C, and to a maximum of 500 J. At these settings, the treatment takes approximately 90 seconds. I have found that placing a second lesion immediately posterior to the first is both safe and effective (Fig 1C). Use of a topical vasoconstrictor at the conclusion of the procedure will help control any mucosal hemorrhage.

The patient is observed for 10 minutes after the procedure to check for bleeding before discharge from the office. Over-the-counter analgesics are recommended for pain, and nasal saline use is encouraged. Nasal steroids, nasal packing, antibiotics, and narcotics are not necessary. The patients are instructed to expect short-term worsening of their obstruction secondary to edema lasting 24 to 72 hours. Regarding level of activity, no restrictions are placed on the patient after the procedure. I ask all patients to return to the office in 4 to 6 weeks for examination and to evaluate their response to the treatment.

Discussion

I have found this to be a minimally invasive and highly effective way to treat chronic inferior turbinate hypertrophy causing nasal obstruction. The major advantage of this procedure is that it is a mucosal sparing technique easily performed under local anesthesia in the office. This method of turbinate reduction, including all preparatory set-up, can be performed in less than 20 minutes, with high patient tolerance and satisfaction. Under direct visualization, the needle can be precisely placed into the target tissue. Disadvantages include the cost of the specialized equipment and the potential for mucosal ulceration and epistaxis. Although the risk of mucosal injury with slough and epistaxis are potential complications, we have not found this to be an issue in our practice. The period of recovery for the patient is minimal, with most preferring to return to normal activity immediately after the procedure. Limitations with this technique include precise control of the degree of soft tissue reduction. This may become an issue when dealing with severe turbinate hypertrophy. A second limitation is access to the posterior aspect of the inferior turbinate. In my experience, this has proven to be an infrequent problem. Our success rate has paralleled that which has been published in multiple prospective studies.⁶⁻⁸ It is reasonable to expect a 70% to 80% subjective improvement in patients treated with this technique.

Conclusion

RF of the inferior turbinates is an excellent office-based procedure for nasal obstruction secondary to turbinate hypertrophy without significant septal deformity.

IONIZED FIELD ABLATION AND VOLUME REDUCTION OF THE INFERIOR TURBINATES FOR NASAL OBSTRUCTION

Method performed by Kelvin C. Lee, MD

This process uses RF energy between uniquely configured electrodes in a saline media to create a field of ionized sodium molecules capable of ablating tissue, with minimal residual energy released in the process. This cold ablation process, or coblation, had been used as a surgical modality for tissue ablation or sculpting for years in other subspecialties. The need to use saline as a medium has certain limitations, but the use of saline gel and intracel-

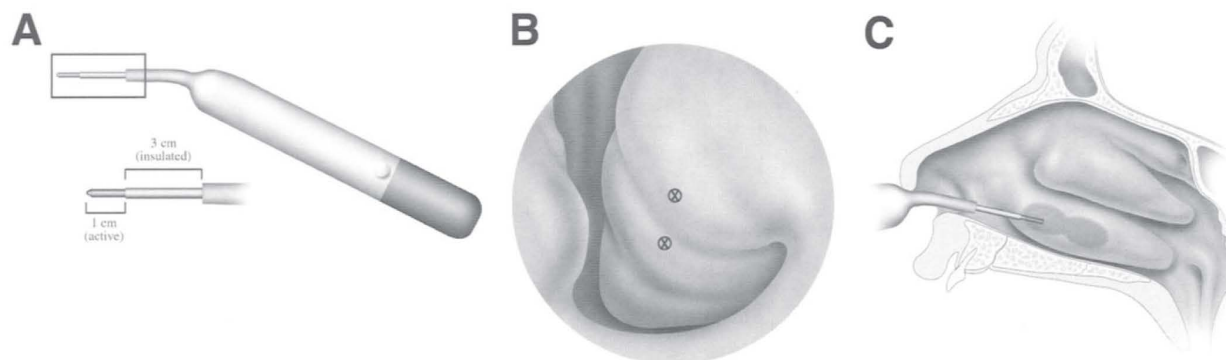


FIGURE 1. (A) Somnus turbinate handpiece with a 1-cm active electrode and a 3-cm insulated portion. (B) Placement of the electrode into the anterior-inferior portion of the turbinate. (C) Creation of 2 sequential submucosal lesions of the inferior turbinate.

lular fluids has allowed the emergence of this technology from the arthroscopic world into other applications. For use in the turbinates, 2 wands that deliver this energy are available; each is designed to create lesions with a slightly different goal. Both wands are designed to use ionized field ablation to enter the mucosa. The Reflex 45 wand (ENTec, a division of Arthrocare, Sunnyvale, CA) has 3 contacts at the tip, and is designed to create a single thermal lesion after being placed submucosally, similar to other RF devices. The Hummingbird wand (ENTec, a division of Arthrocare, Sunnyvale, CA) is a bipolar wand that is only active at the tip. The wand is used to create submucosal tunnels through the turbinate by using ionized field ablation, and then a thermal lesion along this tunnel as it is withdrawn. The remainder of this section will describe the use of this second approach to inferior turbinate volume reduction.

Procedure

This procedure requires the use of the Coblation/Radio-frequency controller (ENTec, a division of Arthrocare, Sunnyvale, CA) and the Hummingbird wand. This wand uses an active electrode at the tip, and a passive return electrode, which is the last 5 mm of the uninsulated shaft. No grounding pad is needed. The remainder of the insulated shaft is approximately 5 cm long, with a 45° bend as it enters the handle (Fig 2A). This device has no other active sensors or switches in the handpiece. The author prefers the use of an endoscope for exact electrode placement, especially if posterior lesions are planned.

The wand design and the shaft length allow easy lesion creation in any aspect of the inferior turbinates. Patient anatomy and severity of inferior turbinate hypertrophy are used to decide the aggressiveness of the treatment used. In most cases, the author uses 4 to 6 tunnels on each inferior turbinate (Fig 2B). The lesions are created in sets of 2 or 3 after the anterior or posterior segment of the turbinate is injected with local anesthesia. The use of the anesthetic makes the procedure comfortable for the patient, but also creates a larger target for the electrodes to pass without inadvertently penetrating the mucosa, as well as providing a sodium medium for ionic field production to take place.

The patient is placed in the examination chair, and topical anesthesia and oxymetazolin are applied to both nasal passages. Pledgets, with both an anesthetic and vasoconstrictive agent, are placed over both inferior turbinates for 5 minutes. The coblation unit is set at a power of

4. The planned treatment site is injected with 3 mL 2% lidocaine with 1/200,000 epinephrine, causing clear expansion of the stroma of the inferior turbinate. Immediately after the stroma is inflated, a saline gel-tipped wand is placed against the anterior mucosa, the coblation mode is activated, and the wand is advanced into the mucosa. With the coblation mode still activated, the wand is advanced along the underlying bone for the planned length of the submucosal tunnel (Fig 2C). After completion of the tunnel, the wand tip is then withdrawn very slowly, with the cautery mode activated. With some limitations, the speed of withdrawal will determine the amount of cautery that occurs, and the degree of stromal volume reduction. This is continued until the active cautery at the tip is seen at the puncture site (Fig 2D). The procedure is then quickly repeated at the other parallel sites as planned. Each pass with the wand requires about 30 seconds, and is well tolerated by the patients. If too much time has passed before the subsequent lesions are created, the turbinate stroma may require reinflation with the anesthetic agent. The use of lidocaine without epinephrine prolongs the time the stroma remains full, but results in more postprocedure bleeding at the puncture sites.

Immediately after the procedure, patients tend to have some bleeding from the puncture sites for about 5 to 15 minutes. Oxymetazolin pledgets are placed over these areas and the patient is observed for about 15 minutes. No packing is usually needed beyond this first 15 minutes. There is very little pain after the procedure and minimal nasal drainage results for the first day or so. Patients are discharged with pain medications as a precaution and seen again at 1 week postprocedure.

At 1 week, most patients feel some improvement of nasal breathing. Examination typically shows slightly irritated dry mucosa with no visible crusting, old blood, or mucosal lesions. By 2 weeks, the patients report complete healing and improved breathing. Some limitation to improvement is related to mucosal disease or anatomic obstruction, but the procedure has been well tolerated and very successful. No complications have been seen with this procedure to date. The resultant turbinate is significantly reduced in size, yet retains its ability to function as a filter and humidifier.

Discussion

The use of coblation-assisted turbinoplasty allows aggressive removal of the vascular stroma through the entire inferior turbinate as an office procedure with minimal

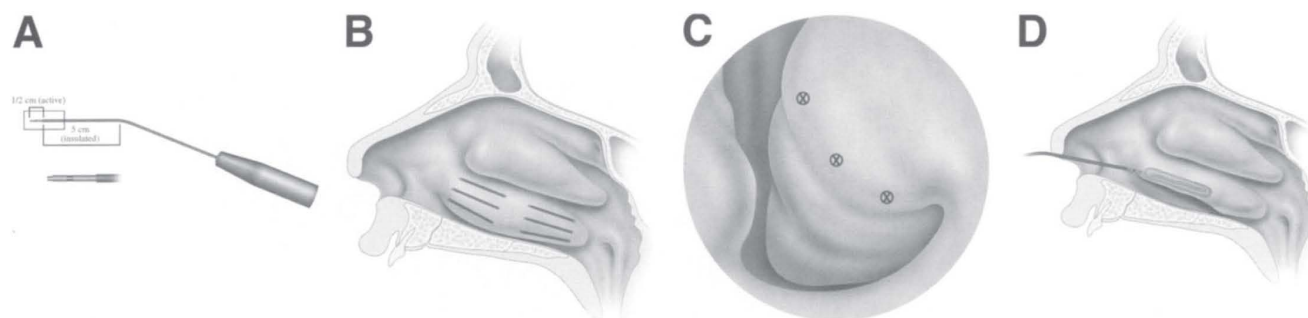


FIGURE 2. (A) The turbinate wand (Hummingbird) for generating the ionized field and bipolar cautery. (B) The array of 6 tunnels used for most patients over each inferior turbinate. (C) Ionized field ablation is used to enter the mucosa and then create tunnels through the submucosal stroma. (D) During withdrawal of the wand tip, bipolar cautery is used to create further thermal injury of the stroma that will cause volume reduction as it heals.

morbidity. The use of the coblation wand removes some of the tissue volume by ionized field ablation, followed by additional tissue reduction as the cauterized tissue in the tunnels created through the turbinate stroma fibrose and are resorbed. This allows preservation of the mucosal surface and minimizes any postoperative pain and crusting. The waiting period before improvement is short, and postoperative morbidity is low, although the initial bleeding in the 15 minutes after surgery can seem significant. This initial bleeding can be controlled by nasal packing, but usually resolves rapidly, and does not appear to be a continued problem after the patient has left the office.

Conclusion

Ionized field-assisted turbinoplasty allows aggressive treatment of the entire inferior turbinate and can be customized to the patient's needs. This procedure can be easily performed in the office and patient recovery is rapid, with minimal pain or nasal complaints after surgery.

POWERED VOLUME REDUCTION OF THE INFERIOR TURBINATE

Method performed by Peter H. Hwang, MD

An alternate means of inferior turbinate reduction is submucous resection with a microdebrider-assisted technique. The goal of microdebrider-assisted turbinate reduction is to excise the erectile soft tissue of the inferior turbinate while preserving the overlying mucosa.

Procedure

The procedure is best performed under endoscopic visualization. The inferior turbinates are infiltrated with 1% lidocaine with 1:100,000 epinephrine. A stab incision is made at the anterolateral surface of the inferior turbinate using a #15 scalpel (Fig 3). The incision should be carried down to the level of the turbinate bone. Next, a supra-periosteal plane of elevation is developed. A suction elevator is helpful to simultaneously clear blood from the surgical plane during the dissection. The plane of elevation should be carried as posteriorly as possible as well as superolaterally along the lateral nasal wall.

At this point, the turbinate tissue can be resected submucosally through the incision. A pediatric noncutting microdebrider blade is best (such as a liposuction-type

blade) to minimize the risk of perforating the overlying mucosa. The active face of the microdebrider blade is positioned facing outward towards the mucosal surface. Soft tissue resection can then be performed under endoscopic visualization. Resection of the most anterior aspect of the inferior turbinate should be emphasized, recognizing its structural contribution to function of the nasal valve. In addition, care should be taken to treat the lateral wall of the nose lateral and superior to the inferior turbinate attachment, because this area also contributes to patency of the nasal valve.

At the conclusion of the procedure, the nose is packed with a small sponge trimmed to size to match the dissected area of inferior turbinate. This is removed after 1 day. Postoperative care includes nasal endoscopy at 1 week and at 1 month to ensure adequate healing. The procedure is readily tolerated as an outpatient clinic procedure under local anesthesia, but is also conveniently performed in the operating room as an adjunct to other sinonasal surgical procedures.

Microdebrider submucous resection of the turbinate can be readily combined with other surgical treatments of the turbinate. Outfracture of the inferior turbinate is an excellent complement to submucous soft tissue resection and is easily performed after completion of microdebrider-assisted turbinate reduction. If resection of the turbinate bone is indicated, a subperiosteal (rather than suprapariosteal) plane of dissection should be developed after incision to facilitate resection of bone and soft tissue.

Discussion

The advantages of a microdebrider approach to the inferior turbinate are several-fold. First, volume reduction is definitive and controlled. In contrast to thermoreductive techniques that yield more unpredictable patterns of soft tissue reduction, the microdebrider technique allows the surgeon to surgically sculpt the turbinate tissue and to immediately see the extent of reduction achieved. Second, the microdebrider can be used to tailor the resection to the individual anatomic variations of each patient. Third, the microdebrider technique preserves turbinate mucosa, which not only allows for more rapid healing, but also preserves the humidification and mucociliary transport properties of the turbinate. Although not proven, mucosal preservation would seem to minimize the risk of postprocedure atrophic rhinitis. Finally, the microdebrider approach offers the versatility of being performed both in the

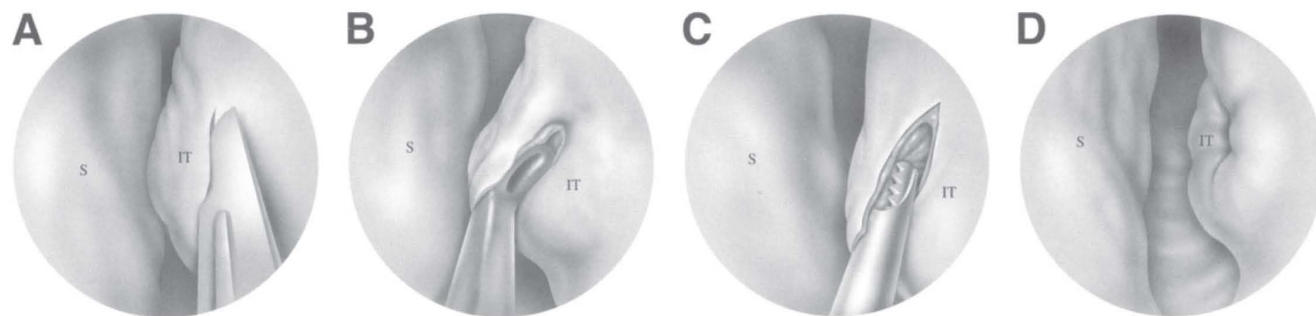


FIGURE 3. (A) Initial incision at anterolateral surface of the turbinate down to the turbinate bone. (B) A pediatric, noncutting microdebrider blade is ideal and allows for resection of the submucosal stroma while minimizing the chances of mucosal injury. (C) Area of dissection and stroma removal should include the turbinate surface and the lateral wall, lateral and superior to the turbinate attachment. (D) The reduced inferior turbinate. (S, septum; IT, inferior turbinate.)

operating room as an adjunct to other procedures and in the clinic as a stand-alone procedure.

The microdebrider approach to turbinate reduction does have a few relative disadvantages. Because tissue is being actively cut, the risk for postoperative bleeding is higher than with thermoablative techniques. Packing does effectively minimize the risk of bleeding, but its use represents an additional inconvenience for the patient. In addition, care must be taken to avoid perforating the mucosal turbinate flap during resection; otherwise, the patient may experience some nasal crusting until the mucosal surface heals.

Conclusion

In summary, microdebrider-assisted turbinate reduction provides a safe and effective means of reducing turbinate tissue volume in a controlled, well-tolerated manner.

OVERALL CONCLUSIONS

New technological advances have offered application of innovative surgical modalities to the management of inferior turbinate hypertrophy. We describe 3 progressively more aggressive approaches to reduction of the submucosal vascular stroma of the inferior turbinates that can be performed in the office with minimal patient postoperative morbidity. These procedures are easily performed, usually successful, and have a high level of patient satis-

faction. Based on an assessment of the patient's specific needs, otolaryngologists can use these techniques to improve a patient's nasal breathing without the expense or bother of a trip to the operating room.

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