Original Research Article

Allergy & Rhinology
1–5

DOI: 10.1177/21526567211034736
journals.sagepub.com/home/aar
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How I Do It: Inferior Turbinectomy: Modified Techniques for Submucosal Resection

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Abstract

Although inferior turbinectomy with submucosal resection effectively reduces the volume of the inferior turbinate, there is room for improvement in surgical procedures. Techniques have been developed to reduce crusting and bleeding while efficiently achieving volume reduction. State-of-the-art procedures pertaining to the local injection site, incision line, exposure of the periosteum, submucosal outfracture of the turbinate bone, trimming of redundant mucosa, and incision line suturing are described. Pre and postoperative Nasal Obstruction Symptom Evaluation (NOSE) scores and postoperative inferior turbinate bleeding and crusting were evaluated. For the 18 consecutive patients analyzed, the pre and postoperative NOSE scores were 67.8 ± 14.8 and 16.1 ± 13.0, respectively ($P = .0002$). Postoperatively, bleeding was absent, and only minor suture thread crusting was observed in 13 patients. In conclusion, our novel technique improves the effectiveness of surgery as well as the postoperative quality of the inferior turbinate.

Keywords

endoscopy, hemorrhage, nasal obstruction, surgical procedures, turbinates

Introduction

Inferior turbinate surgery for the hypertrophied inferior turbinate is one of the most common procedures performed by otolaryngologists. Several surgical techniques are available to treat the inferior turbinate, including total turbinectomy, partial turbinectomy, submucosal resection, laser surgery, cryosurgery, electrocautery, radiofrequency ablation, and turbinate outfracture. Among them, submucosal resection with outfracture is associated with the best outcomes, long-lasting results, preservation of turbinate function, and low complication rates; however, the frequency of crusting and epistaxis is higher with the use of this technique than with the use of other techniques.[1] Crusting is likely to occur in cases in which the mucosal surface is damaged or lost. Epistaxis occurs when small arteries penetrating the periosteum are injured or the mucosal surface is lost. Insufficient reduction results in unsatisfactory improvement of nasal breathing. Little has so far been done to minimize crusting and epistaxis. Herein, we have described the application of multiple adjunctive submucosal resection techniques that were developed to efficiently achieve volume reduction while minimizing crusting and epistaxis.

Materials and Methods

Patients

Patients with the symptom of persistent nasal obstruction despite more than 3 months of medication and the clinical

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finding of inferior turbinate hypertrophy were treated with inferior turbinectomy as described below. A serum allergen-specific immunoglobulin E test was performed to confirm allergic rhinitis. All patients underwent computed tomography preoperatively to assess the paranasal sinuses, nasal septum, and inferior turbinates. In cases of chronic rhinosinusitis and/or nasal septal deviation, endoscopic sinus surgery and/or septoplasty were performed with inferior turbinectomy. Exclusion criteria were septal perforation, previous sinonasal tumor, head and neck radiation, bleeding disorder, or any severe systemic disease. Written informed consent was taken from all the patients. The clinical data were retrospectively reviewed. The authors assert that all procedures contributing to this work comply with the ethical standards of the Helsinki Declaration of 1975, as revised in 2008.

Technique

After the placement of a topical gauze soaked in 2% lidocaine with 1:10 000 adrenaline at the surface of the inferior turbinate, the inferior turbinate was injected with 1% lidocaine with 1:200 000 adrenaline via a 23-G Cathelin needle (Figures 1 and 2 and Video 1). When infiltrating the posterior part of the inferior turbinate, the endoscope was placed below the Cathelin needle so that the needle tip reached the posterior end of the inferior turbinate easily. With the needle tip positioned on the periosteum of the inferior turbinate, 1% lidocaine with 1:200 000 adrenaline was carefully injected. This needle tip position minimized bleeding because there was no chance for the needle to penetrate the mucosa and enter the free space. Moreover, the hemostatic effect of adrenaline was maximized because the periosteum is more vascular than the submucosal tissue. A long mucosal incision was made at the mucocutaneous junction with a 15c scalpel blade so that the entire inferior turbinate was accessible through the incision. The incision was not extended through the periosteum to avoid unnecessary bleeding. Using a 15c scalpel blade, a submucosal space was created to enable visualization of the submucosal tissue.

A microdebrider made for turbinate surgery (2 mm inferior turbinate blade, #1882040HR, Medtronic) or a shaver blade (2 mm, #EGSB2000SA, Olympus) was used to resect the submucosal tissue.[2] As much submucosal tissue as possible was resected to facilitate identification of the periosteum and maximize volume reduction. When resecting the submucosal tissue adjacent to the periosteum, the endoscope was inserted under the mucosa, and the contour of the tissue was examined. The submucosa was resected until the periosteum layer was observed. The periosteum is recognizable because as it is exposed, the submucosal tissue becomes resistant to suction pressure by the microdebrider. When resecting the submucosal tissue adjacent to the surface mucosa, the endoscope was placed outside the inferior turbinate, and the contour of the surface mucosa was examined. The submucosal tissue was resected until the markings of the microdebrider became visible through the remnant mucosa. With the suction off, the tip of the microdebrider was advanced posteriorly along the periosteum. The positions of the endoscope and the microdebrider can be exchanged while treating the posterior part of the inferior turbinate.

After submucosal resection was completed, the turbinate bone was laterally displaced with an elevator inside the mucosa so that the mucosal surface was kept intact. The redundant mucosa was cut and the incision was sutured with 5-0 Vicryl to lift the redundant mucosa. Sorbsan (calcium alginate; Alcare) was placed on the incision line to promote hemostasis and prompt healing. Patients were instructed to start nasal irrigation 3 days after surgery. Patients were also instructed to place a cotton ball in the nostril until the first outpatient visit at 2 weeks postoperatively and to moisturize the nasal cavity. Crusting was evaluated 14 days later during the first postoperative visit (Video 2).

Outcome Measure

Subjective nasal obstruction was assessed using the Nasal Obstruction Symptom Evaluation (NOSE) scale pre and 1 month postoperatively.[3] This scale comprises 5 questions concerning the severity of nasal obstruction, which are evaluated using a Likert scale from 0 (not a problem) to 4 (severe problem). The total score is then multiplied by 5 to obtain a final score ranging between 0 and 100. At the follow-up visit, postoperative bleeding was assessed through nasal examination and a questionnaire and inferior turbinate crusting was assessed via nasal examination.

Statistical Analysis

Continuous variables were expressed as means ± standard deviations. Comparative analyses were performed using Stata version 14.0 (StataCorp). The Wilcoxon signed rank test was used to compare the pre and postoperative NOSE scores. Statistical significance was defined as a *P value* of <.05.

Results

Pre and postoperative NOSE scores of 18 patients (male: 16, female: 2) who received submucosal resection of the inferior turbinate using our novel technique were analyzed. The mean age was 38.7 years (19-71 years). Among the 18 patients, 13 patients underwent concomitant septoplasty and 2 patients underwent endoscopic sinus surgery. The mean pre and postoperative NOSE scores were 67.8 ± 14.8 and 16.1 ± 13.0, respectively ($P = .0002$; Figure 3). Bleeding was not observed in, nor reported by, any of the patients. Minor crusting on the suture that needed no local treatment was observed in 13 patients. Crusting was not observed on the mucosal surface of the inferior turbinate. The 2 weeks postoperatively,

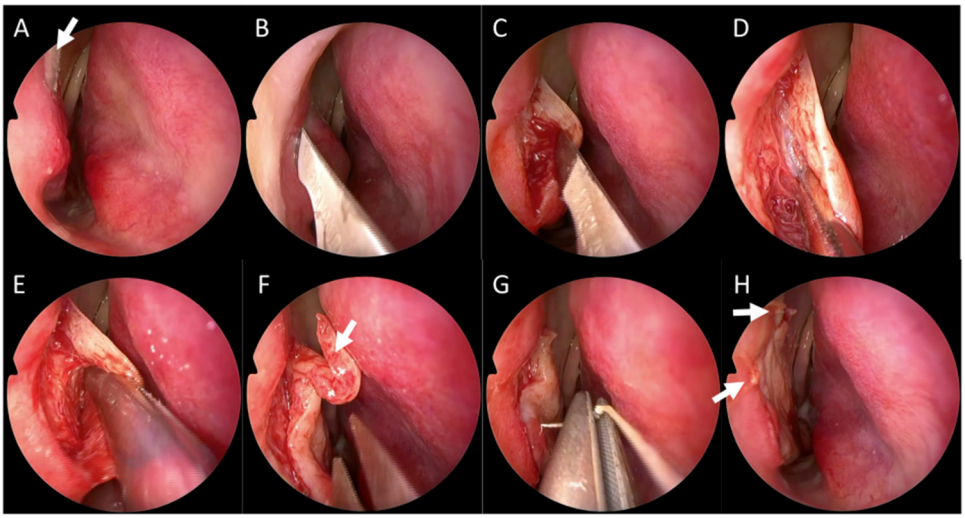

Figure 1. Intraoperative recording for submucosal resection. (A) Local injection with a 23G Cathelin needle (arrow) is performed in the submucosal tissue of the inferior turbinate. The endoscope is placed below the Cathelin needle so that the needle tip reaches the posterior end of the inferior turbinate easily. (B) A mucosal incision is made at the mucocutaneous junction with a 15c scalpel blade. (C) Using the 15c scalpel blade, a submucosal space is created to enable visualization of the submucosal tissue. (D) A microdebrider is used to resect the submucosal tissue. (E) The turbinate bone is laterally displaced with an elevator inside the mucosa so that the mucosal surface is kept intact. (F) Redundant mucosa (arrow) is cut. (G) The incision is sutured with 5-0 Vicryl. (H) Postoperatively, the incision is sutured (arrows), and the submucosal tissue is not exposed.

crusting was observed in 12 patients and 4 weeks postoperatively, crusting was observed in 4 patients. No crusting was observed in 5 patients. Furthermore, crusts that blocked the nasal passage were not found in any of the patients. In the cases where minor crusting was found, it was at the suture thread and did not require removal, which might have caused pain to the patients.

Discussion

Here, we have described several techniques for improving outcomes after submucosal resection of the inferior turbinate. An adequate surgical view, access to the entire inferior turbinate, minimal bleeding, and optimal turbinate mucosal condition can be achieved via these techniques. Our technique is unique in terms of: (1) a long mucosal incision, (2) identifying and preserving the periosteum to avoid bleeding, (3) submucosal outfracture to preserve mucosa, (4) trimming redundant mucosa, and (5) suturing the incision.

Submucosal resection is one of the procedures currently used to reduce the volume of the inferior turbinate. It is less invasive than radiofrequency ablation and laser reduction surgery because it preserves the overlying mucosa, but it is more complicated than other turbinate surgical procedures and requires powered instruments. The microdebrider designed for turbinectomy has a blunt blade at its end that can be used to penetrate the mucosa and the underlying submucosal tissue can be resected using the microdebrider. Often, the penetrated mucosa tears and the submucosal tissue are exposed. Bleeding and crusting are more likely to occur in such situations. We incised the anterior surface of the inferior turbinate vertically with a sharp blade as described by O'Brien et al[4] and we used a 15c blade, which is small and thus easy to maneuver in the narrow nasal cavity. Mucosal incision leads to distribution of the tension applied to the mucosal edge and unintentional tearing does not occur. Submucosal tissue is dissected with the same blade as the one used for mucosal incision. As a consequence, the thickness of the tissue on the periosteum becomes apparent, which makes maximum submucosal resection possible without injuring the periosteum.

The chance of bleeding can be minimized by avoiding trauma to the periosteum. A recent anatomical study showed that the primary blood supply of the inferior turbinate is through the descending palatine artery and its branches within the inferior turbinate.[5] These branches were observed in the periosteum when dissecting in the subperiosteal plane. The submucosal tissue underlying the mucosa is carefully resected while observing the contour and movement of the mucosa.

We administered 1% lidocaine with 1:200,000 adrenaline injection to minimize bleeding during surgery. Although lidocaine/adrenaline injection is necessary to obtain a bloodless operative field, the potential risks associated with lidocaine/adrenaline injection, such as cardiovascular morbidity, should be kept in mind.[6]

Outfracture of the turbinate bone is effective when combined with submucosal resection.[7] No detailed descriptions of the methods used to fracture turbinate bone with an

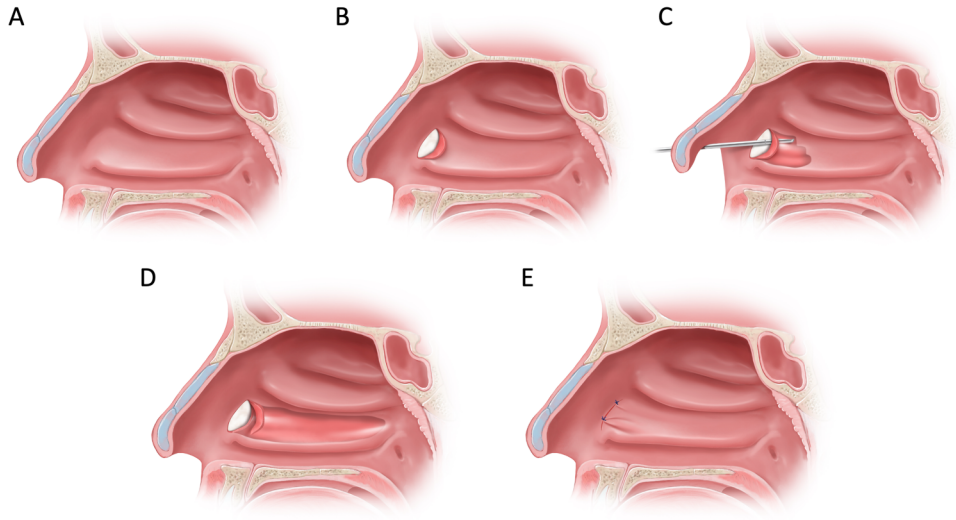

Figure 2. Diagram of the operative procedure. (A) A right nasal cavity is seen from the medial side. (B) A mucosal incision is made at the mucocutaneous junction with a 15c scalpel blade. (C) Using the 15c scalpel blade, a submucosal space is created to visualize the submucosal tissue. Then, a microdebrider is used to resect the submucosal tissue. (D) The submucosal tissue is resected. (E) The incision is sutured with 5-0 Vicryl.

elevator have been described. Presumably, surgeons apply lateral pressure at the surface of the inferior turbinate. We inserted the elevator into the submucosal cavity and applied pressure at the periosteum of the inferior turbinate. By doing so, the surface mucosa was kept intact. We surmise that this method protects the mucosal surface and thus reduces the risk of postoperative crusting.

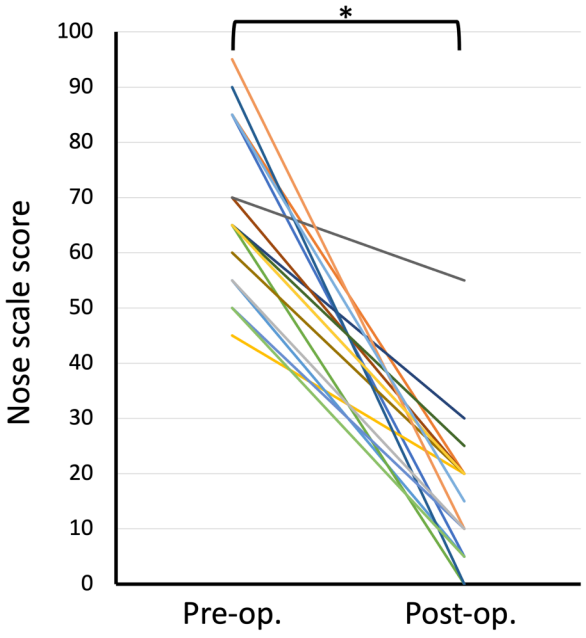

Figure 3. Pre and postoperative nasal obstruction symptom evaluation scores. *$P = .0002$.

The additional incision at the anterior end of the inferior turbinate is not commonly performed. Traditionally, surgeons used the tip of the microdebrider blade to penetrate the mucosa. In this blinded manner, the position of the blade tip cannot be accurately be recognized. Moreover, it is challenging to create a submucosal space close to the periosteum in this manner and there is a high risk of mucosal damage. In cases in which the submucosal space has not been adequately created, it is difficult to resect the entire submucosal tissue because of the limited movable range of the microdebrider. In addition, the contour of the periosteum is not observable using the traditional technique. By making a long incision at the anterior end of the inferior turbinate, these 2 disadvantages of the traditional technique can be overcome. We resected the redundant mucosa to prevent postoperative swelling and sutured the mucosal incision with 5-0 Vicryl to lift the posterior mucosa. By suturing the incision, the surface is entirely covered with mucosa. If it is not sutured, the submucosal tissue may be exposed to the surface, leading to crusting. The suture does not need to be removed, so associated patient stress is minimal. Sorbsan is often washed away at the first visit 14 days postoperatively. Minor crusting at the suture was observed in 13 patients. The suture thread is a foreign body in the nasal cavity; therefore, it has a tendency to form a crust. Crusting was more common at 2 weeks than at 4 weeks postoperatively. There was no need to remove the crust in any patient because, even when it existed, it was tiny and not likely to cause infection or symptoms.

In our facilities, cotton ball packing at the nostrils has long been used to moisturize the nasal cavity and reduce the chance of crusting formation. In a study that verified the

effect of cotton ball packing in the nostrils for 28 days, the use of cotton ball packing after endoscopic sinus surgery reduced the formation of crusts and adhesions.[8] Cotton ball packing was used at our facilities even with the traditional technique. There are no data, but crusting was more frequently observed with the use of traditional technique than with the use of the current technique.

Subjective nasal obstruction was assessed using the NOSE score. A score of 30 differentiates patients with and without nasal obstruction.[9] In patients with nasal obstruction, the severity is categorized as mild (range 5-25), moderate (range 30-50), severe (range 55-75), or extreme (range 80-100). The pre and postoperative scores of our patients (70.0 ± 19.1 and 16.3 ± 7.5, respectively; Figure 3) are acceptable compared to those undergoing other nasal obstruction-alleviating surgeries, for which the weighted average NOSE score was 65 ± 22 preoperatively, decreasing to 23 ± 20 postoperatively, with a mean decrease of 42 points.[10]

There are several limitations to this study. (1) We evaluated only 18 patients and did not include a control group. (2) Objective measurements of nasal airflow, such as rhinomanometry, were not performed to prove the effectiveness of the technique. (3) We did not examine the effect of individual techniques separately, such as: (i) a long mucosal incision, (ii) identifying and preserving the periosteum to avoid bleeding, (iii) submucosal outfracture to preserve mucosa, (iv) trimming redundant mucosa, and (v) suturing the incision. We believe that a combination of our technique has alleviated technical difficulties associated with traditional inferior turbinectomy, but there is a lack of objective data to support our findings. Further studies with larger sample sizes are needed to validate the effects of our techniques.

In conclusion, we have described several techniques for minimizing the crusting and bleeding that often accompany submucosal resection of the inferior turbinate. These techniques make the surgical procedure and postoperative treatment easier.

Acknowledgments

We thank Dr Owen Proudfoot of Editage for the English language editing.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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Supplemental Material

Supplemental material for this article is available online.

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