The Laryngoscope

How I Do It

CO_2 Laser Ablation and Balloon Dilation for Acquired Nasopharyngeal Stenosis: A Novel Technique

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Objectives/Hypothesis: Although acquired nasopharyngeal stenosis (NPS) is frequently attributed to infectious and granulomatous processes, it can also occur secondary to external beam radiation therapy for head and neck cancer. NPS can be treated with local flaps, laser excision, nasal stenting, and combinations thereof. Unfortunately, the postoperative course is frequently complicated by scarring and restenosis that often necessitates multiple revision surgeries. The objective of this study is to report a novel endoscopic approach, employing the use of a flexible CO_2 laser in combination with balloon dilation and mitomycin-C application, allowing for the successful treatment of acquired NPS with lasting results.

Study Design: Retrospective review of case series.

Methods: An endoscope with a working channel is passed transnasally to the location of nasopharyngeal stenosis. A flexible CO_2 laser fiber is then inserted via the working channel of the scope. Precise radial incisions are made on the stenosis using the laser under direct visualization. The laser is removed, and a controlled radial expansion balloon dilation device is inserted, advanced to span the segment of stenosis, and inflated to achieve adequate dilation. Mitomycin-C is then applied topically to the area of dilation.

Results: Three patients with severe NPS were treated using this novel technique. All patients had successful long-lasting dilation of NPS without complications over a follow-up period ranging from 12 to 18 months.

Conclusions: Acquired NPS can be successfully treated with durable results with radial laser incisions and controlled radial expansion balloon dilation.

Key Words: Acquired choanal stenosis, nasopharyngeal stenosis, CO_2 laser, balloon dilation.

Level of Evidence: 4.

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INTRODUCTION

Although nasopharyngeal stenosis (NPS) is primarily a congenital anomaly (choanal atresia), acquired forms also occur. Acquired NPS is often attributed to infectious and granulomatous processes, but the etiology is often unclear and left to speculation. Recently, it has also been increasingly recognized as a late complication of external beam radiation for head and neck malignancy.[1–6] Patients with NPS also frequently suffer significant morbidities, including phonatory changes, sleep disordered breathing, and otologic disturbances.[1,3] Acquired NPS is most commonly treated by endonasal endoscopic surgery and stenting. We describe a novel endonasal surgical technique with demonstrated durable results without the requirement for nasal obturator or stent placement. This procedure could potentially also be performed under local anesthesia in the clinic setting.

MATERIALS AND METHODS

Operative Technique

Under general anesthesia, a small bore flexible scope with a working channel such as a bronchoscope or a transnasal esophagoscope is passed through the nostril to the nasopharyngeal stenosis (Fig. 1). A flexible CO_2 laser fiber (Omniguide, Boston, MA) is then inserted via the working channel of the scope. Precise radial incisions are made using the laser under direct visualization (Fig. 2). Typically, four to six radial incisions are made, each at evenly divided distance to the adjacent mucosal cuts (e.g., 12, 3, 6, and 9 o'clock, respectively). The depth of each incision is dependent on the thickness of the stenotic band. Centrally, the stenotic scar band is frequently thin, and full-thickness incisions are created. Laterally, the incisions may only be partial thickness due to thickness of scar bands in this area. A controlled radial expansion (CRE) balloon dilator (Boston Scientific, Natick, MA) is then inserted, advanced to span the segment of stenosis, and inflated to achieve adequate

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Fig. 1. Nasopharyngeal stenosis, predilation. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

dilation (Fig. 3). Balloon inflation diameters for the patients described here ranged from 16 to 18 mm. The balloon is left inflated for 25 to 30 seconds prior to deflation. Dilation and radial incisions may be repeated as necessary (Fig. 4). Mitomycin-C may be applied topically to the area of dilation as adjunctive therapy. The authors use a concentration of 0.4 mg/mL on cotton pledgets for a total duration of 4 minutes. Postoperative care includes endoscopic evaluation 2 weeks postoperatively and every 3 months thereafter to monitor for restenosis. Debridement of the nasopharynx may be performed at these visits; however, it was the authors' experience that little debridement was required following this procedure.

CASE REPORTS

Case 1

A 56-year-old male who received postoperative radiation therapy following composite mandibulectomy and

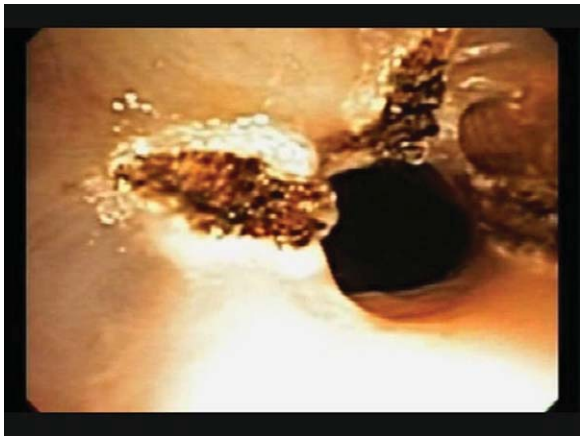

Fig. 2. Stenotic segment with radial CO_2 laser incisions. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Fig. 3. Controlled radial expansion balloon dilation. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

fibular free-flap reconstruction for squamous cell carcinoma of the oropharynx presented with progressive nasopharyngeal and supraglottic stenosis 2 years after treatment. Over a course of 18 months he underwent several dilations with CRE balloons alone, as well as cold-steel incision of a prominent posterior scar band combined with CRE balloon dilation, but he continued to have restenosis of the nasopharynx. Thus, in conjunction with CO_2 laser supraglottoplasty and dilation of laryngeal stenosis, the nasopharyngeal stenosis was treated with radial incisions using the flexible CO_2 laser, CRE balloon dilation, and topical mitomycin-C application.

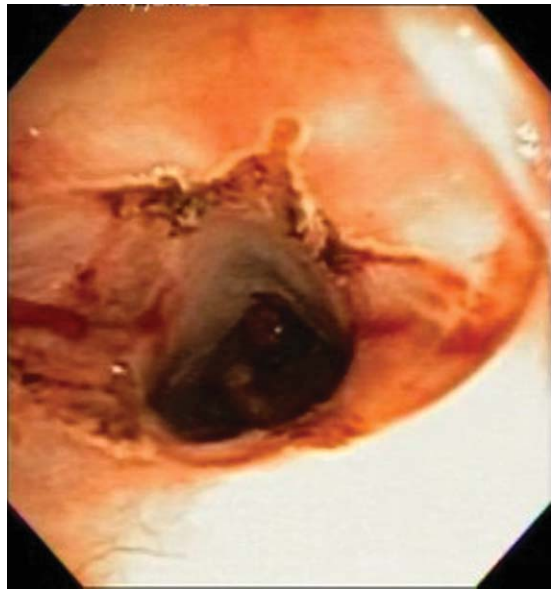

Fig. 4. Nasopharynx, postdilation. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Case 2

A 68-year-old woman with a remote history of idiopathic subglottic stenosis presented with significant granulation tissue and early fibrosis in the nasopharynx. Biopsies of the tissue were negative for an infectious, autoimmune, or malignant process. The patient returned to the operating room several times during the next 18 months for management of her subglottic stenosis, chronic sinus disease, and bilateral serous otitis. She developed a near complete choanal stenosis over time, which was then treated with radial incisions with the flexible CO_2 laser, CRE balloon dilation, and topical mitomycin-C application.

Case 3

A 52-year-old man treated with external beam radiation for squamous cell carcinoma of the tonsil 15 years prior presented with severe laryngeal, hypopharyngeal, and nasopharyngeal stenosis. The nasopharyngeal stenosis was treated with radial incisions using the flexible CO_2 laser, CRE balloon dilation, and topical mitomycin-c application.

RESULTS

There were no complications associated with treatment of nasopharyngeal stenosis. The first patient had his tracheostomy decannulated since the treatment of his supraglottic and nasopharyngeal stenosis, and his nasopharynx remains widely patent at 15 months follow-up. The second patient developed crusting in the nasopharynx at 8 months after the laser procedure. After debridement of the crusting, gentle dilation of the nasopharynx was performed in the office with the balloon dilator. Her nasopharynx remains widely patent at 18 months follow-up. The third patient eventually underwent a total laryngopharyngectomy for recalcitrant stenosis of the larynx and hypopharynx. Interestingly, his nasopharynx remains widely patent at 12 months follow-up without additional procedures. The overall change in the diameter of the nasopharyngeal lumen was similar for each patient. All patients had near-complete stenosis on presentation with a luminal diameter 3 to 5 mm. Dilation was achieved to a diameter of 16 to 18 mm. All patients maintained a patent nasopharynx postoperatively without evidence of restenosis.

DISCUSSION

Acquired NPS after external beam radiation therapy is an important consideration in the otolaryngology patient.[2,4,6] Severe stenosis of the nasopharynx is historically difficult to manage, as it contributes to considerable patient discomfort and frequently recurs after treatment.[1,4] Surgical access to the nasopharynx in the treatment of severe stenosis may be accomplished using a transpalatal or transseptal approach; however, these methods have largely been replaced by transnasal endoscope-based techniques.[5,6] The most common procedures performed in the management of acquired NPS include primary excision and local flap coverage, primary excision and the placement of stents, and simple dilation.[3,5,6] Variations in these techniques exist, each with its own catalogue of benefits and disadvantages.

Although the use of the CO_2 laser has been described previously to treat nasopharyngeal stenosis, long-term stent placement, often required postoperatively to prevent restenosis, was a disadvantage of this technique.[1,3] We have successfully treated severe nasopharyngeal stenosis under direct visualization using a transnasal endoscope and a flexible CO_2 laser fiber placed through the working channel to make radial incisions of the stenosis, CRE balloon dilations, and topical application of mitomycin-C. The relatively recent and more widespread availability of the flexible CO_2 laser fiber is advantageous in its ability to both access and remain mobile within confined spaces such as the nasopharynx. By combining the flexibility of the optical CO_2 laser with that of the transnasal scope, the operator is able to create precise radial incisions under direct magnified observation on the video monitor. Although the present authors chose to use a flexible scope to pass the laser fiber, the procedure could also be accomplished by passing the laser fiber through an appropriately sized curved nasal suction or laser handpiece, and the operation could be visualized using standard rigid endoscopes used in endoscopic sinus surgery. Notably, the importance of both radial incisions and radial dilation has been established in the treatment of stenoses of the larynx and trachea.[7] By the same principles, the ability to preserve epithelium and minimize mechanical and thermal trauma are also likely essential for optimal results in the nasopharynx as illustrated in our cases. Using this technique, each patient discussed was able to maintain patency of the nasopharynx on multiple serial examinations.

Our technique uses the combination of several methods previously demonstrated to treat luminal stenosis; therefore, the individual contribution of each component to the lasting results of this technique is unknown. The combination of radial incisions with balloon dilation likely plays the largest role in the maintenance of patency. This technique preserves viable epithelium between the radial incisions, allowing for re-epithelialization of injured tissue prior to the onset of scar contracture. The use of each technique in isolation is frequently less effective and/or requires stenting postoperatively. The addition of mitomycin-C serves as a useful adjunct in preventing rapid recurrence of scar.

Despite similarities between this technique and others used to correct nasopharyngeal stenosis, the typical postoperative crusting frequently encountered in postdilation patients was not appreciated here. As a result, not only did the patients described maintain nasopharyngeal patency, little debridement was required during surveillance visits. It should be noted, however, that our patients have a postoperative follow-up period of 12 to 18 months, and the potential for late restenosis of the nasopharynx may still exist. Finally, although not used in this report, an additional advantage of this technique is the possibility of performing the laser incision and dilation under local anesthesia as an office-

based procedure. Unfortunately, as seen with the patients described here, nasopharyngeal stenosis rarely exists in isolation. More commonly, other concurrent stenoses involving the upper aerodigestive tract are present, and may require general anesthesia for their management.

CONCLUSION

Acquired nasopharyngeal stenosis after external beam radiation therapy for head and neck malignancy adds to patient morbidity, and its treatment can be frustrating to both the patient and surgeon. However, it can be successfully repaired with durable results using an optical flexible CO_2 laser to make radial incisions of the scar followed by controlled radial expansion balloon dilation and topical application of mitomycin C.

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