Radiofrequency volume tissue reduction of the tonsils: Case report and histopathologic findings

Alyssa R. Terk, MD; Steven B. Levine, MD

Abstract
Innovative new techniques to resect tonsillar tissue have been described in the recent literature. We report the case of a patient who underwent volume reduction of tonsillar tissue by radiofrequency energy under local anesthesia in an office setting. Treatment resulted in a reduction of tonsillar size with minimal pain, which can be attributed to the avoidance of mucosal interruption. The patient subsequently underwent standard tonsillectomy, which allowed us to examine the histopathology of the tissue that was treated with radiofrequency. In doing so, we noted an absence of fibrosis and preservation of normal histologic architecture. We conclude that performing volume reduction of tonsillar tissue by applying radiofrequency energy to the stroma of the tonsils without temperature control results in objective improvement in airway size with minimal effects on the histopathology of the tonsillar stroma. Mucosa-sparing tonsillar reduction may be a preferable alternative to other techniques of tonsillar reduction, especially for young children, who would experience a nearly pain-free procedure.

Introduction
Hypertrophy of the palatine tonsils can lead to upper airway obstruction in children and adults and is an indication for surgery. Three procedures have been described to address this common otolaryngologic problem: (1) complete excision of the tonsils by dissection of the tonsillar capsule from the adjacent parapharyngeal muscles (tonsillectomy), (2) near-total removal of the tonsils with preservation of the tonsillar capsule and a small amount of lymphoid tissue (subtotal or supracapsular tonsillectomy), and (3) reduction of the lymphoid elements of the tonsils with preservation of the overlying mucosa (tonsil reduction or volume tissue reduction of the tonsils).

Mucosa-sparing tonsillar tissue reduction has been proposed as an alternative to total and subtotal tonsillectomy. Radiofrequency volume tissue reduction (RF-VTR) makes use of the application of current density around the electrode tip to destroy tissue. Over a period of 4 to 6 weeks, the treated area contracts and the total tissue volume is reduced. Three examples of radiofrequency devices:

- Somnus (Gyrus ENT Division; Memphis, Tenn.) operates at 460 kHz and has a temperature-control sensor.
- ENTec Coblator (Arthrocare; Sunnyvale, Calif.) operates at 100 kHz at an effective temperature of 60° to 100° C.
- Ellman Dual-Frequency IEC-II (Ellman International; Hewlett, N.Y.) uses radiofrequency energy at 4.0 MHz in monopolar mode and 1.7 MHz in bipolar mode.

Nelson introduced RF-VTR of the tonsils with the Somnus radiofrequency generator. He used a specially designed monopolar needle probe that limits the heating of surrounding tissues by continuously monitoring and controlling the temperature of the treated tissue. The results of his studies in adults were promising, as he reported an average increase in airway size of 1.2 cm. Patients were treated in an office setting, and most returned to pretreatment activity within 1 or 2 days. Tissue continued to shrink over the ensuing 12 weeks, and at the 1-year follow-up, airway size remained stable. Complications and postoperative pain were minimal. Nelson speculated that this was perhaps attributable to the lack of disruption of the mucosa, capsule, and the glossopharyngeal and vagal nerve fibers in these tissues.

In this article, we describe the case of an adolescent who was treated with the submucosal application of radiofrequency to the deep stroma of the tonsillar tissue in order to reduce tonsillar size. The patient later required a full excision of the tonsils, which allowed us the opportunity
to examine the effect that RF-VTR had on tonsillar histopathology and architecture.

Case report
A 16-year-old girl was referred by an oral-maxillofacial surgeon to the senior author (S.B.L.) for management of hypertrophic tonsils before she was to undergo maxillo-mandibular surgery to correct a bite deformity. The patient had no complaints or history of sore throat, snoring, or difficulty swallowing. Given the lack of symptoms and the goal of adequately reducing the tonsils in preparation for the corrective orthognathic surgery, she accepted our offer to perform RF-VTR of the tonsils rather than standard tonsillectomy. She ultimately underwent this procedure twice.

Photographic documentation of the oral cavity and oropharynx before and after both procedures was performed in a standard and uniform manner. The tip of the same 4.0-mm, 0° nasal endoscope was placed between the maxillary central incisors. The images were captured with the same video camera system and printed by the same Polaroid printer. With a tongue blade on the central portion of the tongue, the patient was asked to phonate in order to tense the oropharyngeal musculature and medialize the tonsils. Intertonsillar distance was measured at its shortest point (figure 1).

Local anesthesia was achieved by injecting 2% lidocaine and 1:100,000 epinephrine into the anterior and posterior pillars. The complete procedure was performed in an outpatient clinic setting, and only analgesics were prescribed.

We used the Ellman Dual-Frequency IEC-II radiofrequency generator. In the bipolar mode, this unit delivers energy with a wavelength of 1.7 MHz. A specially designed bipolar probe with two fine needles was used to deliver energy into the deep portion of the stroma without injuring the overlying mucosa (figure 2). With power set at 2 W, energy was delivered for no more than 5 seconds to four nonoverlapping areas in each tonsil.

The patient reported some discomfort on postoperative day 1, which she managed with acetaminophen only; she did not take any of the codeine that we had prescribed. By postoperative day 2, she had resumed her normal diet and was experiencing only minor throat discomfort. By postoperative week 4, the distance between the nearest portions of the palatine tonsils was 0.6 cm; while this represented a 100% increase in the preoperative distance of 0.3 cm, it was not an extraordinary improvement.

Because further reduction of her tonsillar volume was desired, the patient underwent a second treatment 8 weeks following the first. Five nonoverlapping areas in each tonsil were treated. Energy was delivered for no more than 10 seconds during each application at the same 2-W power setting. She experienced no pain following the procedure, and she did not take any acetaminophen. Six weeks later, however, the distance between the nearest portions of the palatine tonsils was still 0.6 cm.

Given that the reduction in tonsillar size with RF-VTR was only moderate, the patient underwent standard tonsillectomy under general anesthesia, with microcautery dissection in the areolar plane between the tonsillar capsule and surrounding muscle. Once the tonsils were removed, we performed a histologic examination of them to determine what effect RF-VTR had on the tissue. Hematoxylin and eosin (H&E) staining of multiple sections of both tonsils revealed that the architecture of the germinal centers was normal and that there was no evidence of increased fibrosis deep to the tonsillar capsule (figure 3).

Discussion
Tonsillectomy. Tonsillectomy often causes significant postoperative discomfort that can result in days lost from school or work. In addition to pain, postoperative complications include difficulty swallowing (which can lead to dehydration), uvular edema, hemorrhage, and infection. Several methods of tonsillectomy other than traditional cold dissection and electrosurgical dissection have been studied in an effort to decrease the amount of postoperative pain.

The harmonic scalpel technique involves the transfer of high-frequency ultrasound to mechanical energy, which is then used to break bonds.4 This transfer is associated with a small lateral zone of injury. Children younger than
7 years experience a quicker return to a regular diet than do older patients, but they consume an equal amount of analgesics in comparative postoperative periods.

Clinical experience with lasers has been mixed. Results with the CO₂ laser have been favorable, but this procedure requires more operating time because precautions must be taken to protect nearby tissues and the endotracheal tube.⁵ Treatment with the KTP-532 laser is associated with delayed and increased pain; it is also relatively expensive.⁶ Coblation tonsillectomy has been addressed in three studies, and these results have also been mixed. Shah et al noted that coblation resulted in a smaller zone
of thermal injury on pathology, but this did not translate into an earlier recovery or a change in narcotic requirements. Moreover, coblation actually took longer to perform because of the need for irrigation and suction.

In a pediatric population, Temple and Timms compared bipolar dissection with coblation wand dissection in the peritonsillar plane with the use of an operative microscope. They found that coblation resulted in less intraoperative blood loss, less postoperative pain, and earlier healing of the mucosa.

Back et al reported a randomized controlled comparison of coblation tonsillectomy and standard tonsillectomy in adults; they found no difference in postoperative pain or return to activity.

It appears that most studies conclude that regardless of the tool used, no significant decrease in pain medication requirements can clearly be demonstrated using any of the above technologies for tonsillectomy.

**Subtotal tonsillectomy.** Subtotal tonsillectomy (what Linder et al called tonsillotomy) has been touted as an effective means of reducing tonsillar tissue while causing less postoperative pain. Pain is mitigated by sparing the capsule and thus avoiding exposure of parapharyngeal muscle fibers. This procedure is performed primarily on patients with enlarged tonsils that have caused obstructive symptoms. It is contraindicated in patients with frequent tonsillar infections because it involves leaving a layer of tonsillar tissue on the capsule in the tonsillar fossa.

Subtotal tonsillectomy has been performed with a Sharplan 1025 CO2 laser (Lasers Industries; Tel Aviv), with an ENTec coblation plasma-mediated ablation device, and with a Xomed microdebrider (Medtronic Xomed; Jacksonville, Fla.). A study of subtotal tonsillectomy using Ellman 4 MHz radiosurgery is currently under way in Sweden (E. Hultcrantz, MD; written communication; October 2002). The results of these studies have also been mixed.

Hultcrantz et al compared standard tonsillectomy with subtotal tonsillectomy with a CO2 laser in children with obstructive sleep apnea. Patients in the laser-resected group were pain-free after 5 days, compared with 8 days for those in the control group. The authors noted that the laser-treated group experienced less intraoperative blood loss, less need for pain medication, and an earlier return to normal weight.

In another study of subtotal tonsillectomy, Lee and McLaughlin used an ENTec coblation system, irrigation, and suction to sequentially remove tonsillar tissue in lay-
ers. Their preliminary study demonstrated an earlier return to diet and normal activities in all 10 patients reported.

Koltai et al compared standard electrosurgery with subtotal tonsillectomy via the Xomed microdebrider in 312 children. They reported that the microdebrider partially resected the tonsil and that suction cautery controlled bleeding in the tonsillar bed. Patients in the subtotal tonsillectomy group experienced less pain, but there was no difference between the two groups with respect to their return to a normal diet or normal activity.

**RF-VTR of the tonsils.** Another means of reducing pain is to ensure that the mucosa of the tonsil is minimally interrupted or not interrupted at all. Our patient experienced a nearly pain-free procedure and recovery after such a procedure.

Our patient did not experience a radical decrease in tonsillar size after one treatment, and a repeat treatment did not decrease tonsillar size any further. This is likely attributable to the conservative nature in which we performed the procedure. Because this was our first attempt at RF-VTR of the tonsils, we were conservative and limited the amount of energy delivered. We believe that our reluctance to deliver more energy limited the clinical efficacy of the procedure in this case. It is possible that application of energy for a longer period or at a higher power would have reduced the size of the tonsils even more.

Histopathologic examination of our patient’s subsequently excised tonsils revealed that radiofrequency did not change their architecture. The germinal centers were intact and normal. This finding supports the idea that radiofrequency does not alter the function of the tonsils. Clinically, it suggests that hyperplasia of the remaining lymphoid tissue might be a concern later on, especially in adults. We believe that subsequent hyperplasia of remaining tonsillar tissue might be less of an issue in children younger than 3 years because concerns about airway compromise become less pronounced as children grow.

Our findings support those of Nelson—namely, that adults with obstructive symptoms can be treated with RF-VTR in an outpatient setting with minimal pain and a rapid return to function. Further studies in children should be considered because it is possible that they too would likely experience minimal pain and a rapid return to a normal diet.

**References**

13. Lee KC, McLaughlin LA. Subtotal tonsil ablation using coblation for tonsillar hypertrophy. Presented at the Eastern Section meeting of the Triological Society; February 2001; Toronto.