Operative Techniques in Otolaryngology (2012) 23, 102-105

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Operative Techniques in

Otolaryngology

Office-based laser laryngeal surgery

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KEYWORDS
Laser;
Larynx;
Vocal fold;
Office;
Phonosurgery;
KTP;
PDL

Office-based laryngeal procedures have returned to popularity driven by technological advances, convenience, patient preference, and economic factors. The pulsed dye laser and the pulsed potassium-titanyl-phosphate laser are photoangiolytic lasers that are well suited for treatment of laryngeal pathologies such as recurrent respiratory papillomatosis, dysplasia, and vascular lesions. The advancement of distal-chip nasolaryngoscopes and lasers allows safe, effective, and cost-saving treatment of these laryngeal pathologies in the office setting. This article describes the author's method for performing office-based laryngeal surgery with angiolytic lasers.
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Office-based procedures are an appealing way to treat laryngeal pathology for several reasons. The development of distal-chip nasolaryngoscopes allows laryngologists to perform a variety of procedures with accuracy and precision previously only available in the operating room. The procedures can be performed quickly and safely, without general anesthesia or sedation, and allow patients to return to work or home without the need to be accompanied. They are spared the expense of a trip to the operating room, anesthesia, or a hospital stay and have been reported to save more than $5000 per case.[1] They can be scheduled on short notice and repeated as necessary. Patient acceptance of these procedures is extremely high. In a survey performed by Rees et al,[2] 87% of patients who had experienced both in-office unsedated pulsed dye laser treatments and surgery under general anesthesia preferred the office-based laser procedure.

Laser surgeries are among the mainstays of office-based laryngology procedures. In general, the ideal laser should be safe, reliable, easy to use, efficacious, specific to the target tissue, and predictable in its results. There are 2 main laser types that are in use for these procedures. The 585-nm pulsed dye laser (PDL) was first introduced to laryngology in 1998 by McMillan et al[3] for the treatment of recurrent respiratory papillomatosis (RRP) of the larynx. The PDL was adapted from dermatology, where it was used as an angiolytic laser in the treatment of vascular lesions such as port-wine stains. The 585-nm laser takes advantage of a nearby peak in the light absorption spectrum of oxyhemoglobin to provide selective destruction of blood vessels, with minimal thermal damage to surrounding soft tissue or overlying epithelium.[4]

The 532-nm pulsed potassium-titanyl-phosphate (KTP) laser is another angiolytic laser, but it targets a different peak in the oxyhemoglobin absorption spectrum. Its use in laryngology stems from the desire to avoid vessel rupture-related hemorrhage from the PDL. It is thought that the longer pulse width (usually greater than 30 times as long) allows more even heating of the blood and decreases the chance of vessel wall rupture.[5]

The 3 lasers commonly in use for office-based laryngeal procedures are the Photogenica SV 585-nm PDL (Cynosure, Westford, MA), the Aura XP Starpulse pulsed KTP (American Medical Systems, Minnetonka, MN), and the IQ 532 pulsed KTP (Iridex, Mountain View, CA).

Indications

There are several common indications for office-based laser laryngeal surgery. This approach has been used most fre-

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1043-1810/$ -see front matter Published by Elsevier Inc.
doi:10.1016/j.otot.2011.11.008

quently for RRP and recurrent vocal fold leukoplakia/dysplasia. It should be noted that patients with suspected RRP or dysplasia are first treated in the operating room with a conventional surgical procedure and biopsy. It is important to have pathological diagnosis of the lesions to ensure that carcinoma is not overlooked. Other indications that have been reported with varying degrees of efficacy include varices, ectasias, vocal process granulomas, Reinke's edema (polypoid degeneration), vocal fold scarring, and vocal fold polyps.

Patient selection is a crucial factor in successful surgery. Patients must be able to sit upright in an examination chair without the benefit of oxygen supplementation. They need to tolerate flexible nasolaryngoscopy with minimal anxiety and gagging. Patients with advanced pulmonary disease will frequently adduct the true and false vocal folds during expiration to provide auto-positive end-expiratory pressure. This excessive movement makes office-based laser procedures difficult and is a relative contraindication.

Technique

The unsedated patient is seated in an office examination chair. Topical anesthesia and decongestion of the nasal cavities are performed with a 1:1 mixture of 4% lidocaine and 1% phenylephrine spray into the more patent nostril immediately on entering the examination room to allow for maximum mucosal shrinkage before the procedure. Rarely, in patients with tight nasal passages, 1 × 3-inch cotton pledgets soaked in the same solution can be placed between the inferior turbinate and the nasal septum and floor to facilitate the procedure.

Adequate laryngeal anesthesia is probably the most important factor after patient selection in achieving a successful office laser procedure. Care should be taken to provide proper anesthesia to ensure patient comfort and cooperation during the procedure. There are many methods described to anesthetize the larynx, including nebulized anesthetic, atomized spray through the oral cavity, dripping anesthetic solution through the working channel of the nasolaryngoscope, and superior laryngeal nerve (SLN) blocks. My preferred technique, however, is transtracheal injection of 4% lidocaine. This method is highly effective, quick to perform, and has a short onset of action. Four milliliters of 4% lidocaine are drawn into a 5-mL syringe using a 21 or 22-gauge, 1.5-inch needle. The neck is palpated to identify the cricoid cartilage and trachea. The skin of the anterior neck is then prepped with an alcohol swab. The patient is asked to cover his or her mouth with a tissue to prevent coughing onto the practitioner. The trachea is grasped on each side with the thumb and forefinger of the nondominant hand to ensure the needle is placed correctly into the midline of the trachea. The syringe is held in the dominant hand, and the needle is inserted approximately 1 cm inferior to the cricoid cartilage, around the level of the second and third tracheal rings (Figure 1). After entering the airway, a small amount of air is aspirated into the syringe to confirm proper placement. The lidocaine is injected into the trachea as rapidly as possible, and the patient coughs to spread the anesthetic throughout the laryngopharynx. The nondominant hand is used to stabilize the injection needle at the skin level during injection. The laser procedure can commence after 3 to 4 minutes.

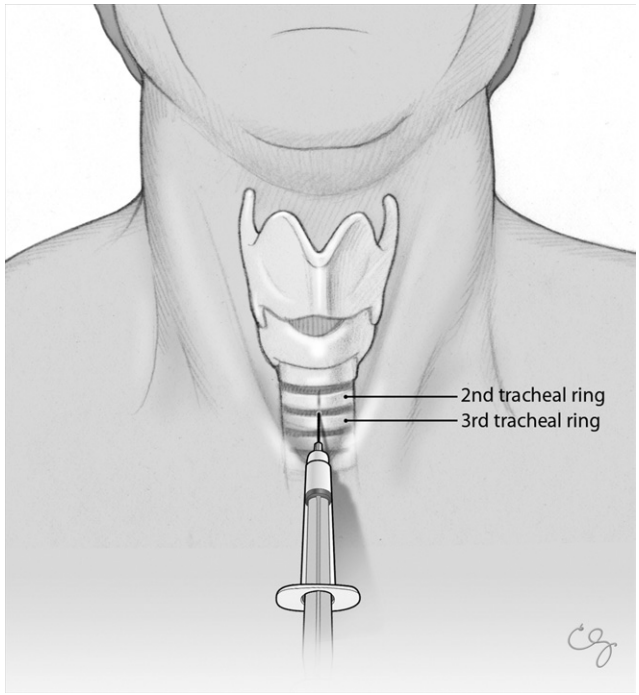

Figure 1 Transtracheal injection of topical 4% lidocaine. The needle is inserted approximately 1 cm inferior to the cricoid cartilage, around the level of the second and third tracheal rings. (Courtesy of Chris Gralapp.)

If the area to be treated has significant involvement of the supraglottis, an ipsilateral SLN block can be considered. The supraglottis is more sensitive than the true vocal folds and therefore may require greater anesthesia. SLN blocks tend to increase pooling of secretions in the hypopharynx, which can obscure the laryngeal introitus or cause coughing and swallowing. Therefore, bilateral SLN blocks are avoided. The block is performed by palpating the greater cornu of the hyoid bone and inserting the needle approximately 1 cm medial and inferior to the landmark until resistance is felt at the thyrohyoid membrane. After negative aspiration for blood, 1 mL of 2% lidocaine is injected into the area where the internal branch of the SLN pierces through the thyrohyoid membrane.

The laser procedure is performed using a flexible nasolaryngoscope with a working channel. Several models are available such as the VNL-1570STK (KayPENTAX, Lincoln Park, NJ) or the ENF-VT2 (Olympus Surgical, Center Valley, PA), both of which are distal-chip scopes with a 2-mm working channel. A distal-chip transnasal esophagoscope can also be used for the procedure if a nasolaryngoscope is not available. It should be noted that the larger diameter of a transnasal esophagoscope can cause greater nasal discomfort for the patient, and the scope is more difficult to manipulate because of the greater length and weight.

Table 1 Laser parameters for 3 common lasers used for office-based laser laryngeal surgery

Laser	Wavelength (nm)	Power (W)	Energy (mJ/pulse)	Pulse width (ms)	Pulse frequency (Hz)
Photogenica SV	585	1111-1667	500-750	0.45	2
AuraXP starpulse	532	35-50	525-750	15	2
IQ 532	532	6	300	50	2

Before activation of the laser, the patient and everyone in the room must don laser eye protection that is rated to the proper wavelength of light. N95 respiratory masks are also worn during RRP cases. The laser parameters are set, and the flexible laser fiber is passed through the working channel of the laryngoscope before insertion of the scope into the nose (Table 1). Care should be taken to ensure that the scope is completely straight when the fiber is passed to protect against damage to the fiber or the working channel. The fiber is adjusted flush to the tip of the nasolaryngoscope. The scope is then introduced transnasally and brought into position at the laryngeal inlet (Figure 2). With the tip of the scope held straight, the laser fiber is advanced until it extends 2 to 3 mm past the tip of the scope. Ideally, the laser and scope are advanced together toward the target lesion; however, the laser fiber can be advanced independently through the working channel if necessary. Treatment is begun at a distance of approximately 1 cm from the lesion to determine the tissue reaction (Figure 3). Suctioning of smoke is performed concurrently via the working channel. The laser fiber is slowly advanced closer to the lesion until blanching of the lesion and coagulation of blood vessels are observed. The laser should be moved slightly between pulses so as not to continuously treat the same area. Rupture of larger blood vessels can occur occasionally if the laser fiber is too close to the target. As the treatment progresses, the laser can be used in contact mode for thicker epithelial lesions. The end point of treatment is blanching of the entire lesion and a small area of surrounding normal epithelium. The tip of the laser fiber may then be used to physically peel the lesion away from the basement membrane of the epithelium. After completion of lasing, flexible endoscopic biopsy forceps (eg, FB-52C-1, Olympus EndoTherapy, Tokyo, Japan) can be introduced through the channel to obtain a biopsy specimen if desired (Figure 4). The patient is instructed to maintain voice rest for 3 to 7 days and to refrain from eating or drinking for 1 hour to reduce the risk of aspiration. The patient is seen for reevaluation after 6 weeks.

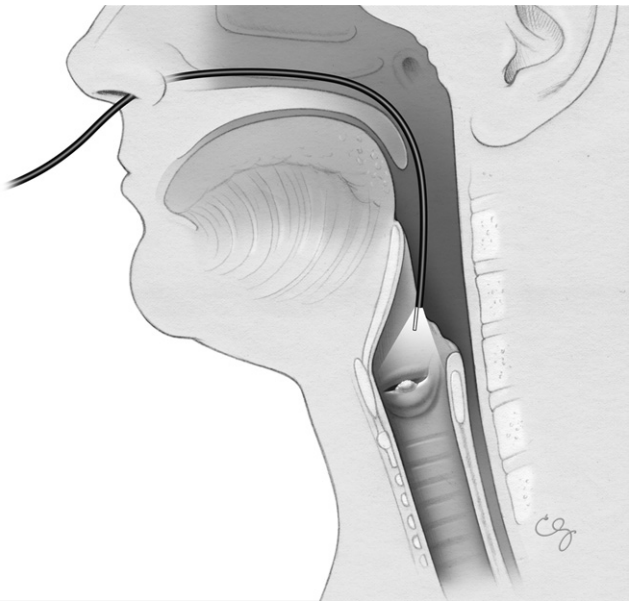

Figure 2 The working channel nasolaryngoscope is introduced transnasally and brought into position at the laryngeal inlet. The laser fiber is advanced 2 to 3 mm beyond the tip of the scope. (Courtesy of Chris Gralapp.)

Complications

There have not been any serious complications with office-based laser laryngeal procedures in my experience or reported in the literature. Vasovagal reactions can happen any time a flexible laryngoscope is passed through the nose. These reactions seem to be less common during procedures owing to blunting of the autonomic response by the higher level of topical anesthesia in the airway. If there is a vasovagal response, the patient is placed in the recumbent position until symptoms pass. A cold wet towel placed on the forehead or smelling salts can be of benefit. Koufman et al[6] reported a 0.9% rate of complications in a series of 406 PDL cases, including 1 vasovagal episode, 2 vocal fold

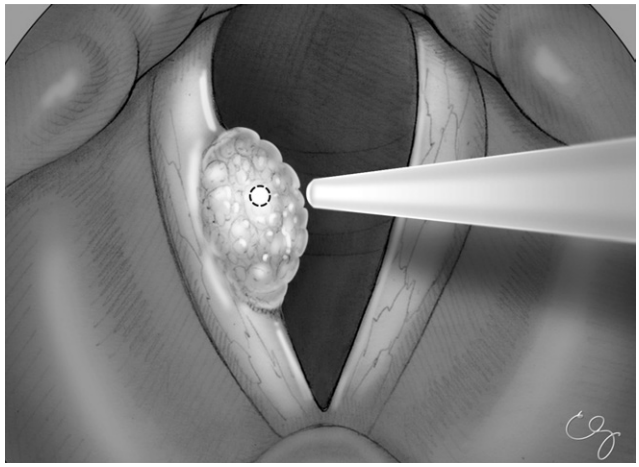

Figure 3 The laser fiber is advanced near the laryngeal lesion. The aiming beam (dotted circle) helps to target the lesion. (Courtesy of Chris Gralapp.)

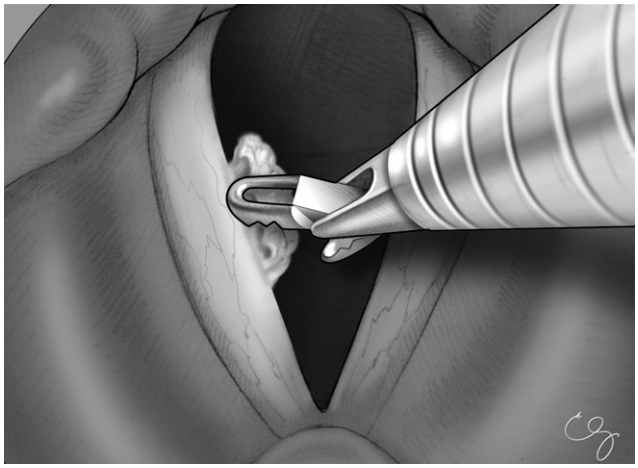

Figure 4 After laser treatment, a biopsy is obtained with flexible biopsy forceps inserted through the working channel. (Courtesy of Chris Gralapp.)

hemorrhages, and an instance of the laser fiber tip breaking off in the trachea (the tip was retrieved immediately with a flexible cup forceps).

Discussion

Office-based laser laryngeal procedures offer distinct advantages over surgical treatment in the operating room. Although factors such as avoidance of the inherent risks of general anesthesia and direct laryngoscopy are important, cost savings and time efficiency may be the driving forces for greater acceptance of these procedures in the current and future medicoeconomic climate. A cost saving of more than $5000 per case has been reported, and 2 to 3 in-office procedures can be performed in the same time frame as 1 operating room procedure. In addition, reduced recovery time, minimal morbidity, and patient preference are other advantages.

There has been a debate in the literature about the merits of the 2 angiolytic laser types for office-based laryngeal surgery. In having experience with both lasers, either one can provide good surgical results, but there are positives and negatives for both. Although the pulsed KTP appears to cause less hemorrhage than the PDL, the PDL has a longer track record for safety and efficacy across multiple institutions. The PDL also has been shown to create a clean cleavage plane between epithelial cells and the basement membrane. This is a useful feature when treating extensive leukoplakia—allowing removal of epithelial lesions with preservation of the superficial lamina propria.[7] By contrast, the KTP laser has a variable pulse width, is a solid-state laser that is less prone to break down than the PDL, and does not require recalibration when power settings are changed. In the end, the argument between the 2 laser camps may be moot, as at the time of publication a PDL designed for use in laryngeal surgery is not currently commercially available for purchase.

Future directions for office-based laser surgery will involve developing a wider range of indications for treatment and validating outcomes of preliminary studies. Other lasers such as the carbon dioxide and the thulium: yttrium-aluminum-garnet lasers have also garnered some usage in the office setting. Additional research may lead to wider usage of these lasers. Although the benefits of in-office laser laryngeal surgery are compelling, the initial high cost of equipment may limit the adaptation of this technology to higher volume tertiary care centers.

Acknowledgment

Original artwork by Chris Gralapp, MA, CMI.

References

1. Rees CJ, Postma GN, Koufman JA: Cost savings of unsedated office-based laser surgery for laryngeal papillomas. Ann Otol Rhinol Laryngol 116:45-48, 2007
2. Rees CJ, Halum SL, Wijewickrama RC, et al: Patient tolerance of in-office pulsed dye laser treatments to the upper aerodigestive tract. Otolaryngol Head Neck Surg 134:1023-1027, 2006
3. McMillan K, Shapshay SM, McGilligan JA, et al: A 585-nanometer pulsed dye laser treatment of laryngeal papillomas: preliminary report. Laryngoscope 108:968-972, 1998
4. Anderson RR, Parrish JA: Microvasculature can be selectively damaged using dye lasers: a basic theory and experimental evidence in human skin. Lasers Surg Med 1:263-276, 1981
5. Zeitels SM, Akst LM, Burns JA, et al: Office-based 532-nm pulsed KTP laser treatment of glottal papillomatosis and dysplasia. Ann Otol Rhinol Laryngol 115:679-685, 2006
6. Koufman JA, Rees CJ, Frazier WD, et al: Office-based laryngeal laser surgery: A review of443 cases using three wavelengths. Otolaryngol Head Neck Surg 137:146-151, 2007
7. Franco RA, Jr: In-office laryngeal surgery with the 585-nm pulsed dye laser. Curr Opin Otolaryngol Head Neck Surg 15:387-393, 2007