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Application of Coblation Resection in Various Benign Laryngotracheal Diseases

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= Abstract =

Objectives : The aim of this study was to evaluate the effectiveness and feasibility of coblation resection for the treatment of laryngotracheal disease. **Methods** : We conducted a retrospective review, evaluating 7 patients with laryngotracheal disease treated using coblator. Information collected included demographic data of the patients, diagnosis, size and location of the disease, procedure time, the number of previous operation, and the postoperative complication. **Results** : Among the etiology, granulation is most frequent (n=4), followed by recurrent repiratory papillomatosis (n=2) and tracheal stenosis (n=1). The location of lesions was peristomal area (n=2), glottis (n=2), subglottis (n=2) and mid-trachea. Coblation resection could remove the lesions completely and there was no significant complication including local burn, bleeding, and hypertrophic scar. The procedure time was shorter than the previous operation using CO_2 laser. **Conclusion** : Coblation resection is an effective and safe method for layngotracheal disease and can substitute the classic method such as CO_2 laser.

KEY WORDS : Laryngotracheal disease · Coblator · Laser · Microdebrider · Tracheal stenosis.

Introduction

Among various laryngotracheal diseases, recurrent respiratory papillomatosis (RRP), reparative granuloma, and airway stenosis have a strong tendency to relapse. Besides, they are potentially life-threatening diseases because of the possibility of airway obstruction by acute exacerbation. Therefore, complete removal of diseased tissue and extending the recurrence interval are essential for managing these recurrent benign laryngotracheal diseases.

To date, CO_2 laser has been the most commonly used modality for treatment of RRP, laryngotracheal granuloma, and airway stenosis. However, there are several disadvantages of CO_2 laser including the significant procedural time to remove a large lesion, risk of airway fire, and distal seeding of the tumor.[1] Therefore, various studies have been reported on the feasibility of other surgical modalities such as the use of the microdebrider or coblator for RRP.[2] The microdebrider's laryngeal blade incorporates a suction device that enables the user to detach the airway lesion from the underlying tissue ; thus, facilitating and expediting the removal of the diseased mucosa.[3] However, it is reported to require more surgical sessions, and to produce more intra-operative bleeding than CO_2 laser.[4,5]

Coblator or Coblation resection is increasingly being used in otolaryngologic procedures such as turbinoplasty, tonsillectomy, and surgery for obstructive sleep apnea.[6-8] In addition, it was used to treat benign tumors of the head and neck.[9] Its precise and non-thermal-disrupting properties make it an attractive alternative therapy for recurrent disease in the tracheobronchial tree. In this paper, we propose that coblation resection should be considered as an option in the management of various laryngotracheal diseases.

Materials and Methods

All protocols and aspects of the experimental design were approved by the Institutional Review Board (IRB) of Seoul National University Boramae Hospital (IRB No. 06-2012-220). From April 2011 through April 2013, 7 cases with various la-

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ryngotracheal diseases treated by coblation resection were enrolled in this case series. In all patients, surgery was performed as described in this article. Clinical features, pre and postoperative findings, procedure time, and complications were analyzed descriptively.

1. Surgical procedure

The operations were performed by one surgeon (Jung YH) under general or local anesthesia (one case under local anesthesia). For laryngeal lesions (glottis and subglottis), the anterior commissure laryngoscope (Kleinsasser laryngoscope) was used ; it provided excellent visualization of the glottis/subglottis. A PROcise^{TM} LW plasma wand (Arthrocare ; Arthrocare, USA) was used to ablate the lesion. For tracheal lesion, approach through glottis is limited when the lesion is 5 cm below the glottis because of the length of the PROcise^{TM} LW plasma wand. Those far distal tracheal lesions were operated through tracheostoma with the guidance of Stryker HD system (Stryker, CA, USA). Peristomal lesions were treated with an Evac 70 Xtra plasma wand (Arthrocare ; Arthrocare, USA) under naked eye or with endoscopic guidance.

The lesion was ablated with a power setting of seven and coagulated with three. The tip of the wand was usually placed at a 90° angle to the mass and suction at the tip pulled the lesion away from the surrounding tissue ; thus, minimizing surrounding thermal damage. The tip was always kept under direct vision. Simultaneous saline irrigation and suction around the tip of the wand were continued throughout the operation. The wand tip was placed in saline to create an adequate environment for the coblation plasma conduction field, and the ablated material at the tip was eliminated before application to the lesion. Saline-soaked neuropatties were applied at the distal area of the lesion to prevent distal airway seeding and aspiration, and the over-flooded saline was carefully sucked out from the glottis and the trachea as the procedure progressed. The lesions were ablated until the underlying the submucosa came into view.

Results

We treated seven patients by coblation resection, including three males and four females (median age : 61.4, range 45−78). Diagnosis of these patients were granuloma (n=4), RRP (n=2), tracheal stenosis (n=1). As shown in Table 1, total procedure time (not including preparation or recovery of the patient) ranged between 5 and 25 minutes (mean time : 13.3±5.7 minutes). No minor or major postoperative complications occurred. Bleeding was minimal and no significant aspiration was detected on postoperative chest X-ray. Regardless of the location and extent of disease, the lesion was completely removed (Fig. 1−3), and all patients reported a lack of symptoms and were free of disease during the follow-up. The mean follow-up period was 7.9± 3.5 months (range, 3−13 months).

Discussion

Since the early 1970s, CO_2 laser using the micromanipulator has been the instrument of choice for the removal of masses originating from or occupying the larynx. The instrument has demonstrated excellent hemostatic ability with fair precision. However, laser causes thermal vaporization of water ; thus, resulting in explosive disruption of cells. The CO_2 laser plume has been hypothesized to cause distal seeding of viral lesions into the tracheobronchial tree[10] and the procedure caries the risk of an airway fire or a delayed onset laryngeal scar, which results in significant morbidity and mortality. The mi-

Table 1. Summary of the 7 patients with laryngotracheal diseases treated by coblation resection

Case	Sex	Age	Diagnosis	Location	Number of surgery	Size (cm)	Procedure time (min)	Postoperative complication	Follow-up duration (month)
1	M	78	Granuloma	Peristoma	1	2.0×1.5×1.2	7	None	12
2	F	58	Granuloma	Peristoma	1	1.2×1.2×1.0	10	None	8
3	F	45	Suprastomal stenosis	Suprastoma	1	1.5×1.0×1.2	25	None	7
4	M	66	Reparative granuloma*	Glottis	1	2.0×1.8×1.5	20	None	7
					2	2.0×1.5×1.5	15	None	3
5	M	68	RRP	Subglottis	1	2.0×1.5×1.8	15	None	13
6	M	50	RRP	Glottis	1	1.8×0.6×0.5	15	None	10
					2	1.0×0.5×0.5	12	None	9
7	F	65	Tracheal stenosis	Mid-trachea	1	NA	5	None	11
					2	NA	12	None	3
					3	NA	10	None	4

* : reparative granuloma after laser excision of glottis cancer. RRP : recurrent respiratory papillomatosis, NA : not applicable

Fig. 1. Case 2 (F/58) Granuloma, peristoma. The patients of case 5 had history of tracheostomy in October 2011 because of long-term intubation. We operated stomaplasty with EVAC coblator under local anesthesia. The time for coblation resection was 10 minutes and there was no significant surgical complication.

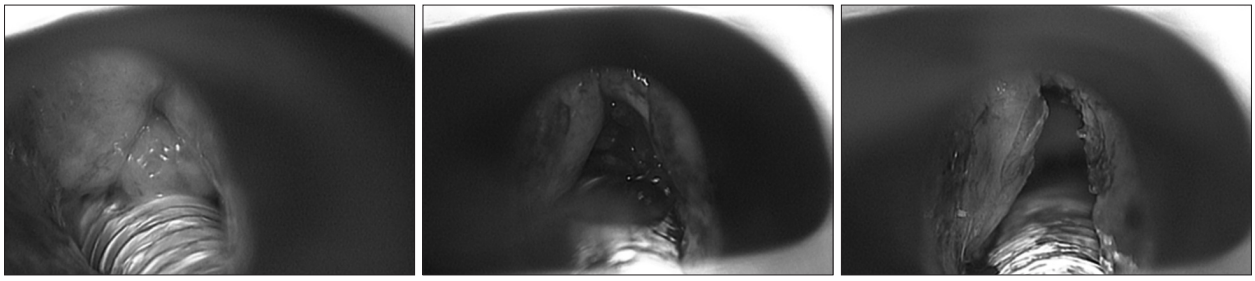

Fig. 2. Case 4 (M/66) Reparative granuloma, glottis. The patients of case 7 had history of glottis cancer which was treated with laryngeal microsurgery (LMS) with CO_2 laser. We operated LMS with laryngeal coblator. The time for coblation resection was 20 minutes and there was no significant surgical complication.

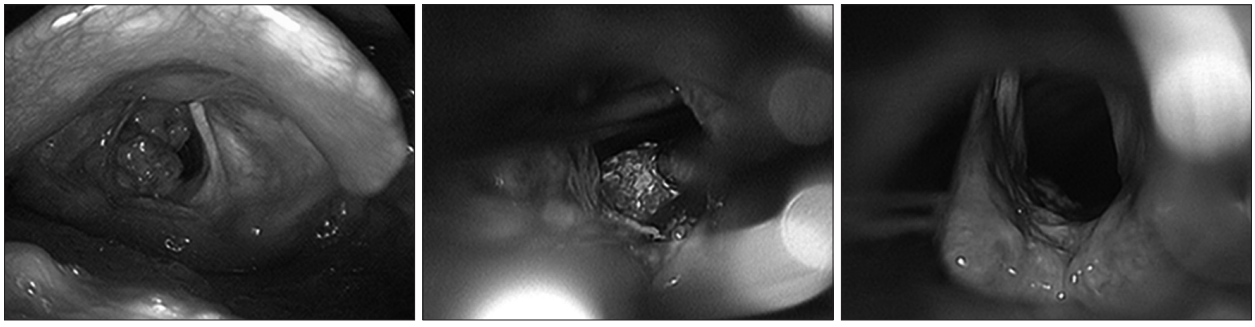

Fig. 3. Case 5 (M/68) Recurrent respiratory papillomatosis (RRP), subglottis. The patients of case 3 had history of over 20 times of laryngeal microsurgery (LMS) due to RRP. We operated LMS with laryngeal coblator under jet ventilation. The time for coblation resection was 15 minutes and there was no significant surgical complication.

crodebrider which was popular for endoscopic sinus surgery has been introduced for removal of laryngotracheal disease after introduction of the customized laryngeal blade. However, copious intraoperative bleeding in sizeable lesion makes surgery time longer and necessitates that this instrument should be used in selected cases of small lesions.

The radiofrequency coblation is now used for the treatment of a variety of otolaryngologic conditions, especially for reducing tissue volume or tissue removal including turbinate reduction for hypertrophic rhinitis ; it is also used for soft tissue reduction to reduce snoring and obstructive sleep apnea. Coblation resection also widely used, especially for tonsillectomy, and is increasingly applied on the laryngotracheal lesion. The radiofrequency energy has been reported to penetrate surrounding tissues to a depth of only 100 μm. Tissue temperatures do not exceed 60℃ in coblation mode, and bipolar coagulation is achieved at low temperatures. There is constant cooling by simultaneous saline irrigation.

For these reasons, coblation and coblation resection gives less local electro-thermal damage to the surrounding tissues than laser.

Besides, the minimal normal tissue damage mentioned above, coblation has several advantages over other instruments. First postoperative pain is significantly less after coblation resection, compared to bipolar coagulation.[6,7] Second, it does not involve a fire risk.[11] Because the coblation plasma field causes direct molecular dissociation, it can denature viral proteins without causing a plume ; the only breakdown products are elemen-

tary molecules and low molecular weight gases. For that, third, coblation avoids the risk for distal seeding, which causes a sense of unease when using laser. Forth, coblation resection could extend the recurrence interval. A recent study has reported that coblation resection of adult laryngeal papilloma resulted in longer periods between interventions, compared with CO_2 laser.[2)]

Compared to the microdebrider, which produces bleeding and aspiration of blood and often require meticulous hemostasis, the use of coblation enables 1) better hemostasis and 2) maintains a clear surgical field by ablating, coagulating, applying suction, and irrigating simultaneously. Moreover, in regard to surgery time, coblation resection enables 3) shorter surgery time than laser and microdebrider. It is due to not only faster removal of the lesion but minimal bleeding during the procedure. For these reasons, coblation resection can be used for alternatives in various laryngotracheal lesions with minimal bleeding and thereby providing good surgical visualization.

Repeated surgical procedures for recurrent laryngotracheal diseases, regardless of the method used, are associated with a high risk of fibrosis and scarring. In this context, radio-frequency ablation could be regarded as the surgical technique that offers satisfactory clearance of the lesion together with less collateral tissue damage ; thus, resulting in less scarring and fibrosis.[12)] In our cases, the lesions were successfully removed without scarring or granulation tissue formation ; this was confirmed not only in the operating room but also during outpatient follow-up.

Another advantage of coblating resection is due to the length and flexibility of the tip of coblator, which makes it possible to approach the target from various angles and minimize the damage of normal surrounding tissue. This also enables coblation resection of various lesions regardless of their location or extent. Moreover, coblatior can be handled with one hand. Another hand can provide endoscopic view rather than microscopic, and the angled endoscopy make it possible to visualize the blind spot in using the microscopy.

In regard to surgery time, our cases had superior results, compared to previous reports with CO_2 laser or the microdebrider. Patel, et al. reported that mean surgery time of pediatric RRP was 59.2 minutes with CO_2 laser and 32.4 minutes with microdebrider.[13)] Considering the severity of each disease, Pasquale, et al. reported that mean surgery time with CO_2 laser in less severe cases was about 14 minutes and microdebrider 10 minutes.[3)] Our mean procedure time was 13.1 ± 5.7 minutes, which was even shorter than the previous reports although direct comparison is inappropriate.

In summary, coblation resection is feasible in various laryngotracheal diseases with fundamental advantages of coblation itself ; 1) minimal normal tissue damage, 2) less painful, 3) lower fire risk, and 4) less distal seeding, and with additional advantages of coblation resection ; 1) extended reprocedure interval, 2) short surgery time, 3) minimal bleeding, and 4) various applications regardless of type, location and extent.

We found that coblation resection can be applied to various laryngotracheal diseases with the aforementioned advantages. It can be widely used in granuloma in peristomal area, glottis or subglottis, and trachea (Fig 1, 2). It is also feasible in airway stenosis in subglottis and trachea. With the advantages of low risk of distal seeding and bleeding, the obstructing tumor, such as recurrent papillomatosis and arteriovenous malformation in the airway can be treated with coblation resection (Fig. 3).

Despite its many advantages, applications of coblation for laryngotracheal disease have several disadvantages. First, the tip is larger than the spot size of CO_2 laser which results in less precise removal of lesion. Therefore, the use in small epithelial lesion like polyp or nodules or malignancy lesions is not indicated yet. Recently, laryngeal coblator with small sized wand was invented to overcome those disadvantages on the small lesion. Second, because the diameter of tip is 4 mm, the coblation instrument itself hinder the lesion, use in pediatric patient with small airway is limited. Third, precautious control of irrigating fluid is necessary for the risk of aspiration of saline, especially when the tip is obstructed by ablated tissue.

Conclusions

We suggest that coblation resection may be a suitable alternative to conventional CO_2 laser and the microdebrider for treating the selected cases of laryngotracheal disease. It is safe and effective for the removal of various laryngotracheal lesions. It has various advantages ; especially ease of use, rapid removal of the lesion, less bleeding and low risk of fire.

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