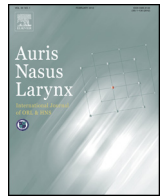




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Comparison of vocal outcomes after angiolytic laser surgery and microflap surgery for vocal polyps

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ABSTRACT

Objective: The microflap technique is a standard procedure for the treatment of vocal fold polyps. Angiolytic laser surgery carried out under topical anesthesia is an alternative method for vocal polyp removal. However, it is not clear whether angiolytic laser surgery has the same effects on vocal outcomes as the microflap technique because of a lack of studies comparing both procedures. In the current study, vocal outcomes after both procedures were compared to clarify the effects of angiolytic laser surgery for vocal polyp removal.

Methods: Vocal outcomes were reviewed for patients who underwent angiolytic laser surgery ($n = 20$, laser group) or microflap surgery ($n = 34$, microflap group) for vocal polyp removal. The data analyzed included patient and lesion characteristics, number of surgeries required for complete resolution, and aerodynamic and acoustic examinations before and after surgery.

Results: In the laser surgery group, complete resolution of the lesion was achieved with a single procedure in 17 cases (85%) and with two procedures in 3 cases (15%). Postoperative aerodynamic and acoustic parameters demonstrated significant improvement compared to preoperative parameters in both the laser surgery group and the microflap surgery group. There were no significant differences in any postoperative aerodynamic and acoustic parameters between the two groups.

Conclusion: The current retrospective study demonstrated that angiolytic laser surgery achieved complete resolution of vocal polyps within two procedures. Postoperative effects on aerodynamic and acoustic functions were similar to those after microflap surgery.

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1. Introduction

Vocal polyps are caused by several factors including vocal abuse and chronic infections [1]. They cause various types of hoarseness depending on their size and location. The primary therapy is surgical removal, with or without voice therapy. The microflap technique was published in 1980s, and became an established surgery between the mid-1990s and 2000 [2,3]. This technique preserves the maximum amount of normal layered microstructure by removing the lesion with minimal damage to the surrounding normal tissue [4], in order to minimize postoperative scar formation of the mucosa. To date, the microflap surgery is the standard strategy for vocal polyp removal.

In cases in which there is difficulty exposing vocal lesions using a laryngoscope or general anesthesia, laser surgery in an office-based setting under topical anesthesia is a feasible alternative treatment for vocal polyps. The lasers used in phonosurgery are divided into two categories: cutting lasers and angiolytic lasers [5]. Cutting lasers include a carbon dioxide (CO₂) laser, while angiolytic lasers include a pulsed dye laser (PDL, 585 nm wavelength), a potassium-titanyl-phosphate laser (KTP, 532 nm wavelength), and a green laser (GL, 532 nm wavelength). Laser surgery in phonosurgery began in the 1970s with the introduction of the CO₂ laser [6,7], which has a 10,600 nm wavelength and is absorbed by water. Although the CO₂ laser has been used for various laryngeal lesions such as cancer, the CO₂ laser causes thermal damage to the surrounding normal tissues, which may lead to vocal fold scarring and postoperative hoarseness. Hochman et al. [8] reported that postoperative stroboscopy revealed an increase in mucosal stiffness in 4 of 19 patients who underwent CO₂ laser surgery, while 23 patients who underwent cold excision showed no such effect.

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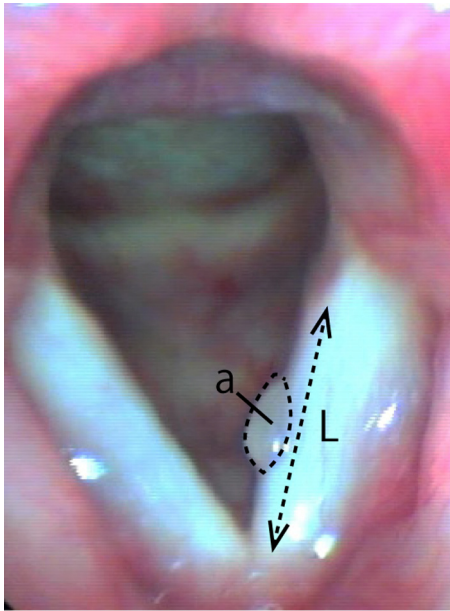


Fig. 1. Measurement of vocal polyp size. 'L' is length from anterior commissure to vocal process; 'a' is area of the vocal polyp in stroboscopic or endoscopic images. The vocal polyp size was defined by the formula $a/L^2 \times 100$.

Angiolytic lasers, which have wavelengths from 532 to 585 nm, are well absorbed by oxyhemoglobin and allow photocoagulation of vessels with minimal damage to the surrounding tissues. Therefore, angiolytic lasers could be expected to achieve the resolution of lesions without postoperative vocal fold scarring. In phonomicrosurgery, angiolytic lasers have been used to treat various lesions such as dysplasia [9], papilloma [10], granuloma [11], ectasias and varix [12,13]. Although several reports [14,15] have indicated the usefulness of angiolytic laser surgery for vocal polyps, it is not clear whether this laser surgery has similar effects on vocal outcomes as compared to the microflap technique. To date, furthermore, there is no consensus on the indication of microflap or angiolytic laser for polyp operation according to the type of polyp including pedunculated, sessile, hemorrhagic, or non-hemorrhagic. In the current retrospective study, the efficacy of angiolytic laser surgery for the treatment of vocal polyps was investigated and compared with that of microflap surgery.

2. Materials and methods

2.1. Patients

A retrospective chart review was performed for 54 patients who underwent angiolytic laser surgery or microflap surgery for vocal

polyps between 2006 and 2012 at Kyoto University Hospital. Twenty patients underwent angiolytic laser surgery and 34 patients underwent microflap surgery. Relevant data collected included patient and lesion characteristics, number of surgeries required for complete resolution of the lesion, and acoustic and aerodynamic parameters before and after each surgery.

It is not easy to precisely determine the size of polyp, but as a parameter that represents the size, the area (a) of vocal polyps and length (L) of entire vocal fold were measured in stroboscopic or endoscopic images with imageJ software, and the vocal polyp size was defined by the formula $a/L^2 \times 100$ (Fig. 1).

2.2. Microflap surgery

Microflap surgery was performed with direct microlaryngoscopy under general anesthesia. After subepithelial infusion of 1: 80,000 epinephrine, superficial cordotomy was performed just lateral to the polyp (mini-microflap). The microflap was elevated, and the content of the polyp was dissected from the superficial layer of the lamina propria (SLP). The polyp was then removed while preserving the epithelium and the SLP (Fig. 2). The patients were instructed to be on complete voice rest for 7 days postoperatively.

2.3. Angiolytic laser surgery

Angiolytic laser surgery was performed via a flexible transnasal endoscope under topical anesthesia in an office setting. The lower pharynx and larynx were anesthetized with a 4% topical lidocaine spray. A green laser (532 nm, Nidek Co., Gamagori, Aichi, Japan) was used to photocoagulate the vocal polyp at a power of 1.5 W with a pulse width of 300 ms and a 500-ms interval between each pulse. The laser was delivered to the lesion through a flexible optical fiber attached to the endoscope. The beam was centered just above the surface of the lesion without actually contacting the lesion with the tip of the fiber. The procedure was completed when the color of the hemorrhagic polyp changed to white (Fig. 3). The patients were instructed to be on complete voice rest for just 1 day.

2.4. Indications for and selection of surgery

Each procedure has certain advantages; the microflap technique is an established surgery to resolve vocal polyps with a single procedure, but it requires general anesthesia and a long period of voice rest. Angiolytic laser surgery is performed under topical anesthesia, which requires a short period of voice rest, but the procedure may need to be repeated for complete resolution of the lesion. Therefore, the selection of surgery type was determined by each patient's needs on a case-by-case basis. Patients who had some risk for general anesthesia were recommended for laser surgery.

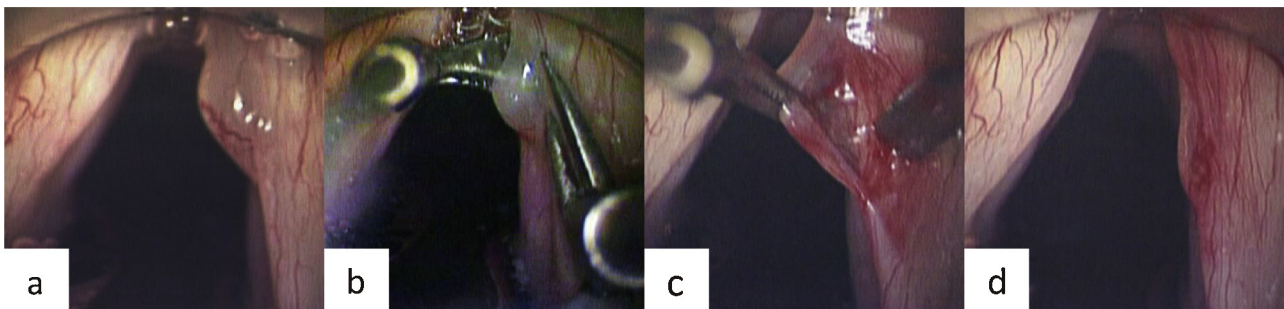


Fig. 2. Microflap surgery. (a) The polyp was visualized with direct microlaryngoscopy. (b) Superficial cordotomy was performed just lateral to the polyp (mini-microflap) and then the microflap was elevated and the content of the polyp was dissected from the superficial layer of the lamina propria (SLP). (c and d) The polyp was removed, preserving the epithelium and the SLP.

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