

Endoscopic Laser Resection of Laryngeal Cancer: Is It Oncologically Safe?

Position Statement From the American Broncho-Esophagological Association

James A. Burns, MD; Gady Har-El, MD; Stanley Shapshay, MD;
Steffen Maune, MD; Steven M. Zeitels, MD

The purpose of this report is to summarize the salient points made during a panel discussion at the 88th Annual Meeting of the American Broncho-Esophagological Association about the efficacy and oncological safety of endoscopic laser treatment of laryngeal cancer. Guidelines for endoscopic laser management of early glottic and supraglottic cancer, including contraindications for this treatment modality, are presented. On the basis of all currently available data, the panel, which critically considered the question of oncological safety, is of the opinion that endoscopic laser resections are oncologically safe when applied judiciously and by a skilled oncological surgeon. Relative contraindications for endoscopic laser resection of laryngeal cancer include instances in which the whole tumor cannot be visualized; large tumors that require removing too much of the functional laryngeal unit, severely decreasing airway protection and leading to aspiration; and cartilage invasion. Specific contraindications for supraglottic cancer include bilateral arytenoid involvement and direct extension into the neck.

Key Words: cancer, endoscopy, glottis, larynx, supraglottis, surgery.

The initial report of transoral excision of early glottic cancer is credited to Bernhard Fraenkel,¹ who in 1886 performed mirror-guided removal of the tumor. Subsequent development of direct laryngoscopy² and suspension laryngoscopy³ led to a broader acceptance of endoscopic cancer resections, and the first reported series of en bloc resection of glottic cancer was presented by Robert "Clyde" Lynch⁴ in 1920. Since then, all advancements in the treatment of early laryngeal cancer have served to enhance surgical precision. Jako, Strong, and Vaughan coupled the carbon dioxide (CO₂) laser to the surgical microscope in 1972⁵⁻⁸ and established endoscopic laser resection of early glottic cancer as a reliable technique. Today, there is broad acceptance of CO₂ laser-assisted excision of early glottic tumors. More recently, the clinical indications of this technique have been expanded to include treatment of recurrent laryngeal carcinoma after irradiation failure,⁹ supraglottic cancer,¹⁰ and advanced (T2, T3, T4) laryngeal cancer.¹¹ In addition, preliminary results on use of photoangiolytic lasers to involute cancer in selected patients appear promising with early glot-

tic disease.¹²

The purpose of this report is to summarize the salient points made during a panel discussion at the 88th Annual Meeting of the American Broncho-Esophagological Association about the efficacy and oncological safety of endoscopic laser treatment of laryngeal cancer. Guidelines for endoscopic laser management of early glottic and supraglottic cancer, including contraindications to this treatment modality, are presented.

BASIC PRINCIPLES OF LASER RESECTION TECHNIQUE

Definitive studies^{10,13-15} of large series of patients have demonstrated the oncological efficacy of laser surgery, and proper patient selection is of paramount importance in determining local control of disease and survival rates. Thorough and precise evaluation of the cancer with direct microlaryngoscopy and appropriate imaging (computed tomography, magnetic resonance imaging, positron emission tomography) is necessary to accurately stage the cancer. Beyond correct tumor staging, the main criterion for endo-

From the Department of Surgery, Harvard Medical School (Burns, Zeitels), and the Center for Laryngeal Surgery and Voice Rehabilitation, Massachusetts General Hospital (Burns, Zeitels), Boston, Massachusetts, the Department of Otolaryngology-Head and Neck Surgery, Lenox Hill Hospital, State University of New York-Downstate, New York (Har-El), and the Division of Otolaryngology, Albany Medical College, Albany (Shapshay), New York, and the Department of Otolaryngology-Head and Neck Surgery, Municipal Hospital of Köln, Köln, and Christian Albrechts University of Kiel, Kiel, Germany (Maune).

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Correspondence: James A. Burns, MD, Center for Laryngeal Surgery and Voice Rehabilitation, One Bowdoin Square, 11th Floor, Boston, MA 02114.

scopic laser resection is adequate endoscopic exposure. Smaller glottic tumors (T1, T2) with limited subglottic extension, minimal or no anterior commissure involvement, and posterior extension not extending beyond the vocal process are ideally suited for endoscopic surgical management. However, improved instrumentation and laryngoscopes that allow for better exposure (especially at the anterior commissure and supraglottis) have expanded the cohort of patients who can be offered endoscopic laser resection.^{13,16-18} Development of laser technologies such as fiber-based cutting capability^{19,20} and selective photoangiolytic lasers¹² that can involute cancer by targeting the blood supply have further expanded the indications for endoscopic laser surgery. Regardless of the approach (piecemeal cutting or involuting), the basic principle is to "follow the cancer" until all disease has been excised or treated. It is now commonly accepted that en bloc excision of the tumor is not necessary, and that it is useful to incise the tumor to determine its depth of penetration. In this way, a precise 3-dimensional resection with optimal margins can be accomplished. Bulky tumors can be sectioned to facilitate complete removal through the laryngoscope speculum. This concept was developed further with photoangiolytic involution using the 532-nm pulsed KTP laser.¹² This laser technology allows for better visualization of the interface of the cancer with normal underlying tissue, which enhances the precision of the procedure.

ONCOLOGICAL SAFETY

In contrast to open procedures with en bloc tumor removal, endoscopic laser surgery often involves resecting tumor in multiple sections. This surgical strategy justifiably carries the concern that cancers may be incompletely resected, or that the very act of sectioning cancers *in vivo* carries an increased risk of regional or distant metastasis, thereby adversely affecting survival. Although some research has concluded that "piecemeal" CO₂ laser resection increases lymph node metastasis compared to en bloc resection in an animal model,²¹ others have argued that the CO₂ laser specifically reduces dissemination by "sealing the cut end of lymphatics."²² Results from studies reporting large series of patients support the oncological safety and efficacy of endoscopic surgery without increased incidence of metastatic spread.^{10,13}

Concern about the oncological safety of endoscopic surgery for glottic and supraglottic cancer is heightened by recent epidemiological observations of decreased overall survival rates for larynx cancer.²³⁻²⁶ These studies, analyzing data from the Surveillance, Epidemiology, and End Results

(SEER) program of the National Cancer Institute, report a decrease in survival in patients with laryngeal cancer — especially patients with regionally metastatic and distant disease. A summary of these reports shows that the decreased survival rates correlate with TNM stage, with a nearly 20% decrease in 5-year survival of advanced glottic cancer from 1977 to 2003. These data suggest that changing trends in cancer management (chemoradiation or endoscopic laser resection as opposed to open en bloc surgical excision) may be leading to a decrease in survival among these patients. Nonetheless, when the SEER data are analyzed for cause-specific survival by age group, the cohort of patients more than 65 years old have a significantly lower survival rate than do younger patients.²⁵ These data suggest that recent treatment trends are not decreasing the rates of survival, because a particular treatment would uniformly affect all age groups. In other words, neither chemoradiation nor endoscopic laser resection appeared to influence the declining survival rates in laryngeal cancer. On the basis of all currently available data, the panel, which critically considered the question of oncological safety, is of the opinion that endoscopic laser resections are oncologically safe when applied judiciously and by a skilled oncological surgeon.

VOCAL OUTCOMES

Studies in the literature concluding that vocal outcomes for patients with early glottic cancer are similar between the treatment groups of radiotherapy and laser surgery²⁷⁻³⁰ have not taken into account innovations such as ultranarrow margins³¹ and phonosurgical reconstruction.³²⁻³⁴ Selection bias, incomplete reporting, small sample size, and differing voice-measuring instruments between studies make interpretation of these studies difficult, but roughly 50% of patients will have at least mild to moderate voice dysfunction after either treatment.³⁵ Expectations for voice outcomes should be stratified according to the extent of surgery, which is often dictated by the extent (staging) of the initial tumor. Patients undergoing laser resection of laryngeal cancer should be counseled that voice results are good, especially for early superficial lesions. Cancers that invade deeper into the vocal ligament or paraglottic musculature will require more extensive surgical resection, and these patients would be expected to have poorer voice outcomes, especially if they do not undergo phonosurgical reconstruction. Strome's group reported that endoscopic laser laryngeal surgery performed in conjunction with cryotherapy for early-stage glottic carcinoma improved subjective and objective measures of voice quality.³⁶ Additional surgeries may be needed for complete cancer con-

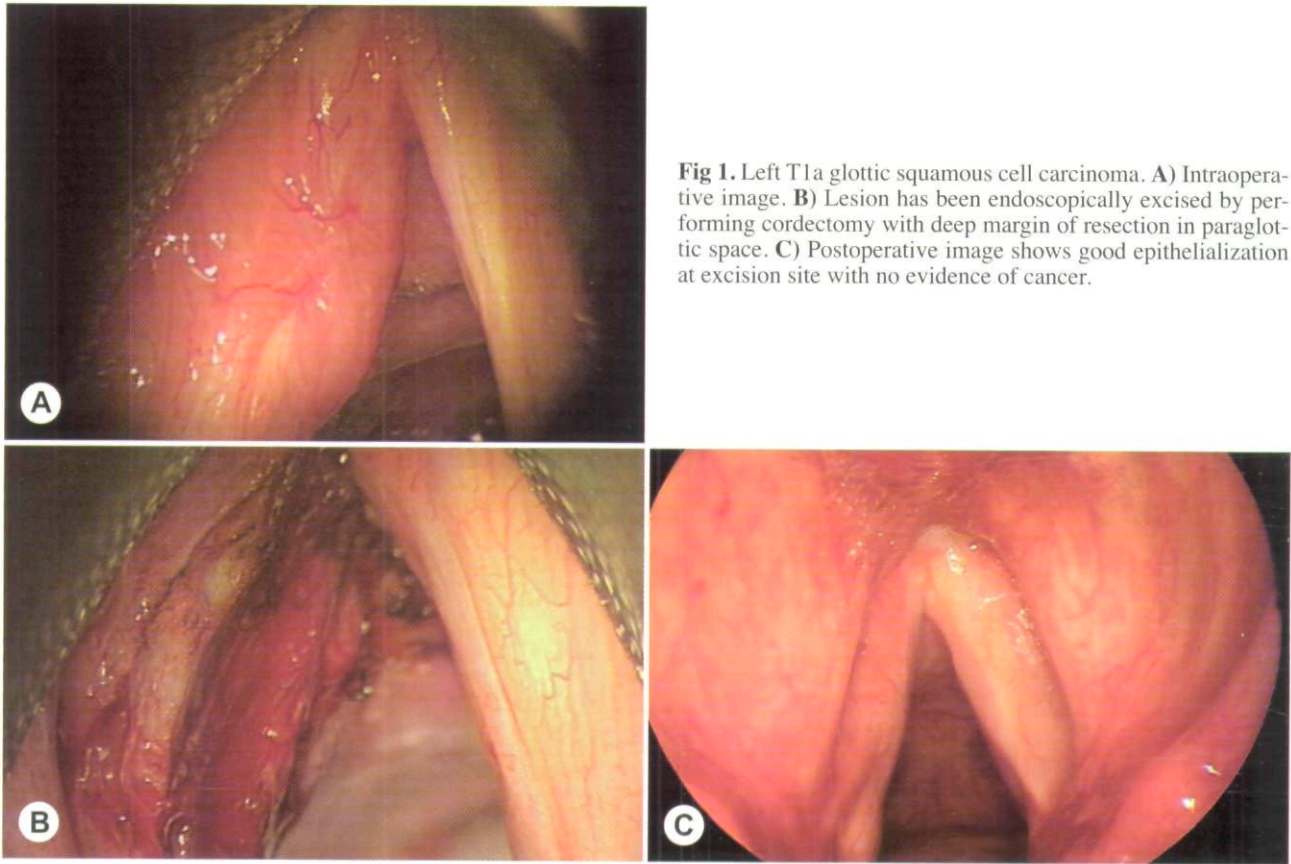


Fig 1. Left T1a glottic squamous cell carcinoma. **A)** Intraoperative image. **B)** Lesion has been endoscopically excised by performing cordectomy with deep margin of resection in paraglottic space. **C)** Postoperative image shows good epithelialization at excision site with no evidence of cancer.

trol, which could also further diminish voice quality. Microlaryngeal and transcervical reconstructive techniques following endolaryngeal cancer surgery are well described and can provide voice restoration for these patients.³⁴ Unavoidable liabilities of radiotherapy are that the normal noncancerous phonatory mucosa can be scarred from radiotherapy and the saccular glands can atrophy, leading to compromised vocal function from diminished mucus production.

EARLY GLOTTIC CANCER

Single-modality treatment (Fig 1) suffices for early glottic disease; Steiner's¹³ early work showed that radiotherapy and endoscopic laser resection offer comparable local control rates. Open partial laryngectomy provides comparable local control rates; however, often the voice result is not as good as with endoscopic treatment or radiotherapy, and the patient typically requires a temporary tracheotomy.³⁷ Review of the recent literature shows the mean 5-year local control rate for T1 cancers with irradiation to be 92% (90% to 94%),³⁸ and 93% (90% to 95%) with endoscopic laser resection.^{39,40} Given comparable local control rates for radiotherapy and endoscopic laser resection, the treatment choice is influenced by voice outcome, preservation of treatment options, cost, and disability (temporary or permanent). Holland et al⁴¹ reported that of 240 patients

with T1 and T2 laryngeal carcinomas treated with radiotherapy, 30% developed second cancers (mean follow-up of 68 months), and 21% of those cancers were in the head and neck. Endoscopic laser resection may therefore be advantageous, because it may be repeated, thereby reserving radiotherapy for a later treatment. Studies have repeatedly shown microlaryngoscopic surgery for early glottic cancer to be more cost-effective than radiotherapy, with comparable quality-of-life outcomes.^{42,43} Finally, in contrast to radiotherapy, endoscopic treatment of early glottic cancer potentially allows for preservation of remaining vibratory tissue, as well as the moistening function of the saccular glands. Subsequent glottic valve reconstruction techniques can then be utilized to enhance functional outcomes.⁴⁴

SUPRAGLOTTIC CANCER

As in the treatment of early glottic cancer, accurate diagnostic staging and imaging of supraglottic cancer (Fig 2) are critically important. Endoscopic laser resection of supraglottic cancer has been shown to be effective and relatively oncologically safe, and surgery is often combined with radiotherapy.^{10,45-47} However, most reports emphasize the importance of limiting endoscopic laser resections to tumors that can be completely visualized. Transoral robotic surgery is a promising new technology that provides

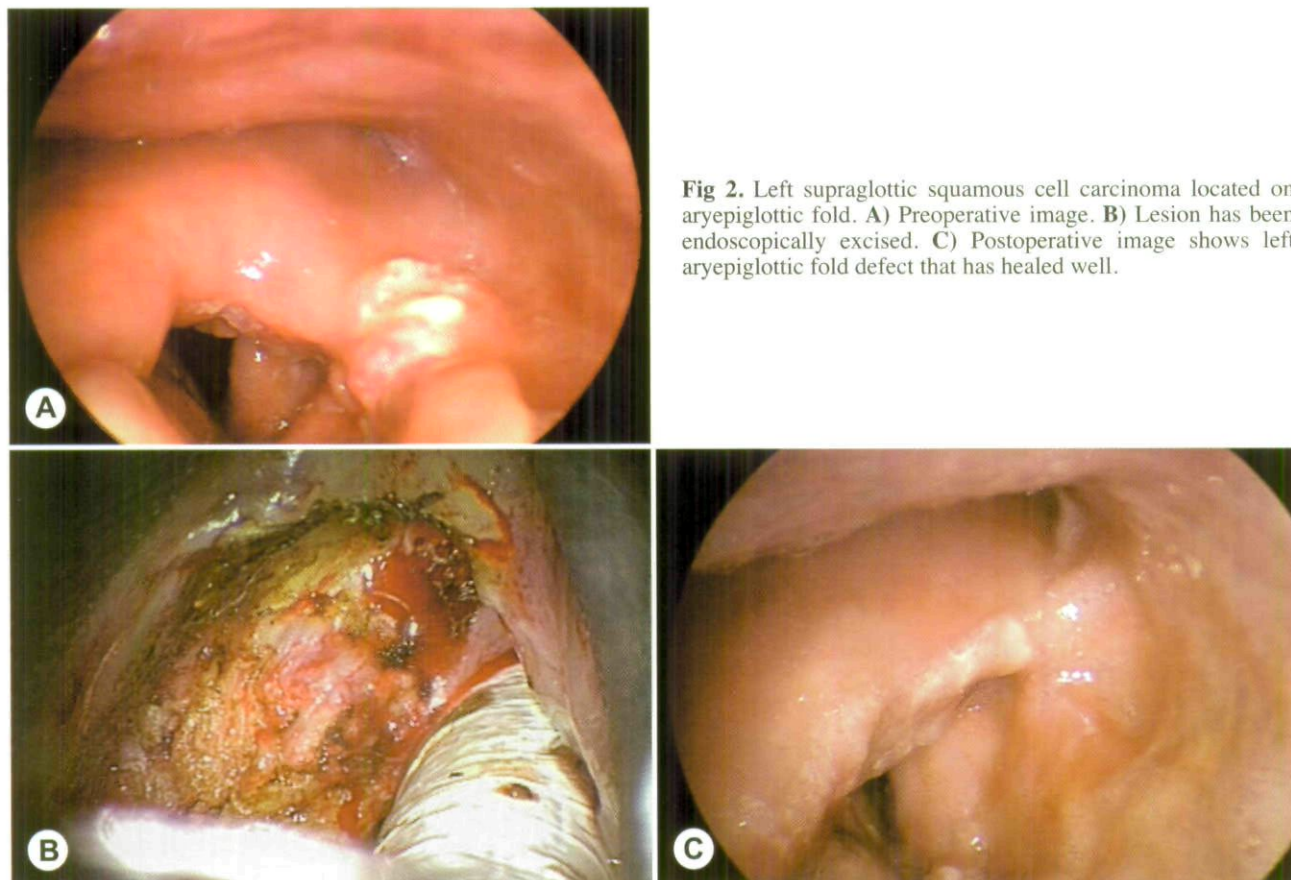


Fig 2. Left supraglottic squamous cell carcinoma located on aryepiglottic fold. **A)** Preoperative image. **B)** Lesion has been endoscopically excised. **C)** Postoperative image shows left aryepiglottic fold defect that has healed well.

an alternative to open approaches, and may aid in ensuring complete tumor removal.⁴⁸ Other studies have concluded that endoscopic resection of supraglottic cancer should not alter the surgeon's standard management of the neck, and that neck dissection is often warranted.^{49,50}

Quality of life, swallowing function, and voice are important considerations following endoscopic laser resection of supraglottic cancer. Several articles report that the functional results are superior to those of the conventional open approach when one evaluates time to restored swallowing, tracheotomy rate, incidence of pharyngocutaneous fistula, and length of hospital stay.^{51,52} As compared to open supraglottic laryngectomy, endoscopic laser supraglottic laryngectomy preserves the glottic closure reflex, which appears to enhance swallowing recovery.⁵² The ability to swallow without aspiration is affected by the extent of laser resection, but eventually is recovered in most patients.⁵³

CONTRAINDICATIONS

Relative contraindications for endoscopic laser resection of laryngeal cancer include instances in which the whole tumor cannot be visualized; large tumors that require removing too much of the functional laryngeal unit, severely decreasing airway

protection and leading to aspiration; and cartilage invasion. Specific contraindications for supraglottic cancer include bilateral arytenoid involvement and direct extension into the neck.

CONCLUSIONS

1. According to the available published reports, endoscopic laser resection for laryngeal cancer is relatively oncologically safe in carefully selected patients. Patients should not be excluded from endoscopic laser techniques on the basis of T-stage, as long as the tumor can be completely visualized endoscopically.

2. Given comparable rates of local control with radiotherapy and endoscopic laser resection for early glottic cancer, surgical management is favored in younger patients, who have a higher likelihood of continuous exposure to carcinogens. Radiotherapy remains a future option in these patients.

3. Advances in robotics, new lasers, and fiber-based delivery systems provide new and novel endoscopic surgical options that can potentially preserve function.

4. Endoscopic laser resection of supraglottic cancer provides functional results that are superior to those of "open" resection, and the disease-specific survival rate compares favorably.

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