Comparison Among Different Available Surgical Approaches in T1 Glottic Cancer

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Objectives/Hypothesis: This study aims to assess the oncologic results of open and transoral surgical techniques in T1a and T1b category glottic carcinomas.

Study Design: Retrospective clinical study.

Methods: The files of 438 T1a and T1b glottic cancer cases managed with primary surgery were reviewed. Transoral laser surgery and open surgical procedures used to treat these cases, including cordectomy, vertical partial laryngectomy, and frontolateral partial laryngectomy, were compared for disease specific survival and local control rates. In addition, all techniques were compared for incidence of major complications and related tracheotomies.

Results: No statistically significant differences were noted between laser surgery and open procedures with regard to disease specific survival and local control for both T1a and T1b cases. Laser surgery showed a significantly lower incidence of complications and tracheotomies.

Conclusions: Laser surgery appears to be a very effective management modality for T1 glottic cancer with comparable results to open procedures and a lower incidence of complications. A transcervical approach should be reserved only for selected cases where individual anatomic factors do not permit complete tumor exposure during diagnostic microlaryngoscopy.

Key Words: Glottic cancer, local control, prognosis, surgery, survival.

INTRODUCTION

Glottic carcinomas represent the majority of laryngeal cancer cases.[1,2] Due to the sparse lymphatic system of the glottic area and the early symptom of hoarseness, glottic cancer can usually be diagnosed at an early stage.[1] The issue of treatment for such cases is, therefore, quite significant because complete cure can often be achieved.[2] There exist many management options for early glottic cancer today. Features such as exact tumor location and extent, and patient and physician choice greatly influence the treatment decision.[3] Besides cure, organ preservation with retention of function has been added as a primary goal of treatment nowadays.[3–5] Additional goals include lowering costs and minimizing the risk of complications.[3,6] Although organ preservation was initially used as a term to describe combined chemotherapy and radiation protocols, today it also includes a wide array of surgical techniques for early glottic cancer.[4] Such techniques aim to cure patients while obtaining optimal functional outcome, and they include endoscopic laser approaches and open laryngeal-preserving procedures.[3]

Comparison between available management options for early glottic cancer, including laser surgery, open surgery, and radiotherapy, remains a complicated issue.[2–4] Unfortunately, there are no definitive, prospective, randomized controlled studies comparing available treatment modalities.[3,6,7] Nonrandomized data are characterized by numerous flaws, with selection bias being the most serious. Additional disadvantages include the use of unorthodox groups of patients, nonstandard therapies, and different types of staging.[6] Despite these problems, nonrandomized data are quite important as they offer the only available basis for treatment decision making.[6] From this scope, the present study aims to retrospectively compare the effectiveness of various available surgical techniques in treating T1a and T1b category glottic carcinomas.

MATERIALS AND METHODS

A retrospective study was conducted at an academic tertiary referral center (Department of Otorhinolaryngology, Head and Neck Surgery, University of Erlangen-Nuremburg Medical School, Erlangen, Germany). Relevant approval from the institutional review board of the hospital was obtained. The files of all patients who underwent primary surgical treatment for T1a and T1b glottic carcinomas between 1970 and 2004 were studied. All pathology reports were reviewed and staging was

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TABLE I.
Different Types of Procedures Used in This Series According to T Category.

Surgical Technique	No. of Cases (%)
T1a	377
TLM	286 (75.8)
Open chordectomy	17 (4.5)
Vertical partial laryngectomy	74 (19.7)
T1b	61
TLM	39 (63.9)
Frontolateral laryngectomy	22 (36.1)
Total cases	438

TLM = transoral laser microsurgery.

conducted according to the 2002 American Joint Committee on Cancer and Union Internationale Centre Contre le Cancer classification.[8] Term T indicates primary tumor staging. Patients with insufficient data, regional and/or systemic disease at the time of diagnosis, and histology other than squamous cell carcinoma, as well as patients with second primary tumors at the time of diagnosis and those who received postoperative radiotherapy and/or chemotherapy were excluded from the study. Moreover, only patients who were observed for at least 60 months were evaluated. Consequently, a total of 438 cases formed the final cohort of the study.

All available surgical techniques, according to T category, were compared for disease specific survival and local disease control rates. Five-year disease specific survival rate is defined as the percentage of patients alive >5 years divided by the total number of patients who died of the tumor of interest. This rate included, therefore, only deaths specifically due to T1 glottic cancer and excluded all other deaths in the patient group. Local disease control reflects the analysis of tumor recurrence in the primary site, and was calculated from the date of surgery to the date of local recurrence diagnosis or date of last follow-up. Local recurrence was defined as invasive carcinoma that developed after completion of initial treatment at the anatomic site of the primary tumor.

Surgical techniques were additionally compared, according to T category, for incidence of major complications and related tracheotomies. Major complications were defined as those that necessitated prolonged hospitalization, blood transfusion, additional surgery, or admission to the intensive care unit. Statistical analysis was performed using the Kaplan-Meier method with 95% intervals, and the chi-square test. The software SPSS version 17 for Windows (SPSS Inc., Chicago, IL,) was used for the analysis. A P value of $<.05$ was considered statistically significant.

RESULTS

Among the 438 patients who were finally included in the study, 412 (94%) were men and 26 (6%) were women. The male to female ratio was therefore 16:1. Mean age in the whole study group was 62.8 years, ranging between 28 and 92 years. No significant differences were noted regarding age and sex distribution among groups of patients undergoing different surgical procedures. Mean follow-up period was 67 months. Overall, 377 T1a and 61 T1b cases were included in the study. The different types of procedures used, according to T category, are presented in Table I. Transoral laser microsurgery (TLM), representing the only transoral approach in this series, was by far the most common procedure for both T categories. Open surgical techniques for T1a cases included cordectomy and vertical partial laryngectomy, and for T1b cases frontolateral partial laryngectomy.

Five-year disease specific survival was 96.5% for T1a cases and 94.3% for T1b cases. Difference between the two categories was statistically significant ($P = .04$). Local disease control was 93.6% for T1a cases and 90.6% for T1b cases ($P = .31$). Kaplan-Meier analysis of overall survival and local control for T1a cases, according to surgical technique, are shown in Figure 1. No statistically significant differences were noted between the different types of procedures ($P = .344$ and $P = .098$, respectively). Kaplan-Meier analysis of overall survival and local control for T1b cases, according to surgical technique, are shown in Figure 2. Again, no statistically significant differences were noted among the different types of procedures ($P = .420$ and $P = .482$, respectively).

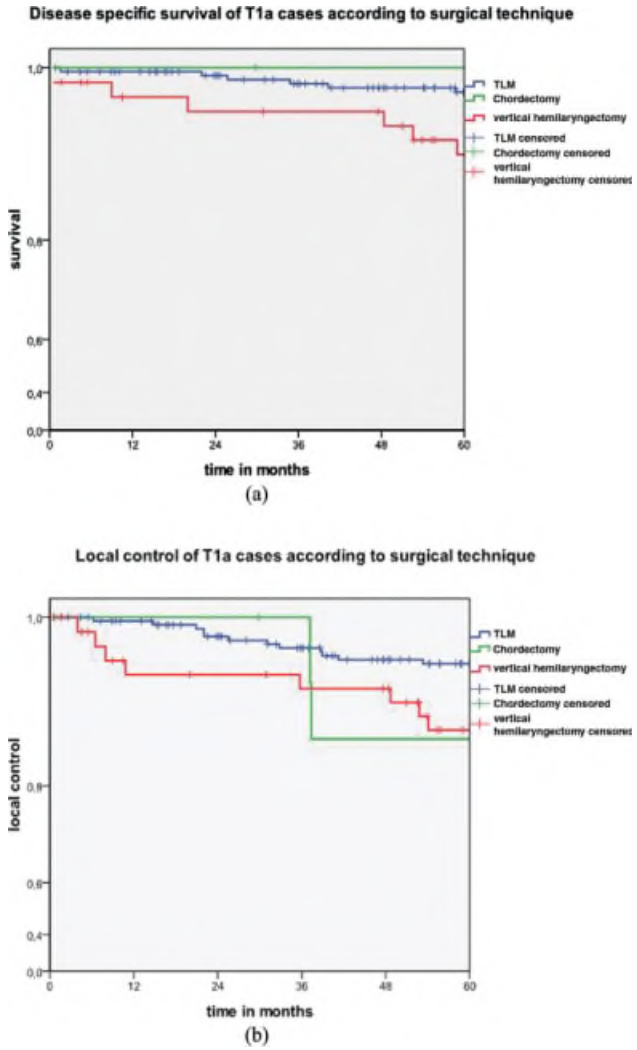

Fig. 1. Kaplan-Meier analysis of (a) disease specific survival and (b) local control of T1a cases according to surgical technique. TLM = transoral laser microsurgery. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

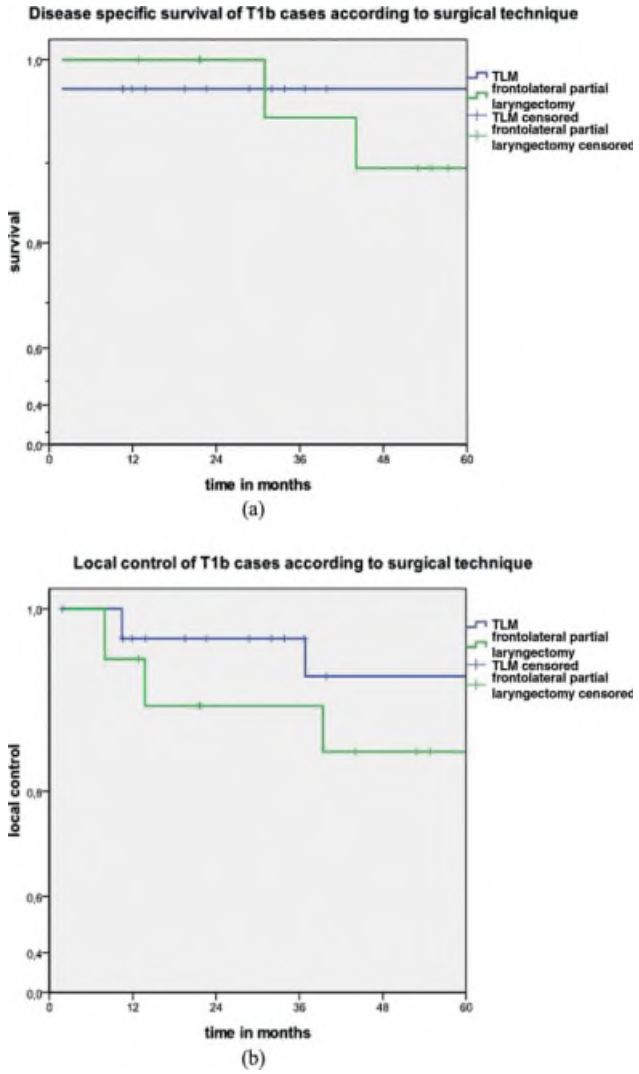

Fig. 2. Kaplan-Meier analysis of (a) disease specific survival and (b) local control of T1b cases according to surgical technique. TLM = transoral laser microsurgery. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

Major complications in this series included postoperative bleeding, aspiration, fistula formation or stenosis, and dyspnea. Specific types and incidence of complications, according to surgical procedure, are presented in Table II. A significantly lower rate was noted for TLM compared to open approaches ($P < .001$). Incidence and type of tracheotomy, according to surgical technique, are presented in Table III. Low rates, especially of permanent tracheotomies, are noted for all surgical approaches. Nevertheless, a significantly lower need for tracheotomy was found regarding TLM compared to transcervical techniques ($P < .001$).

DISCUSSION

Considering the role of the larynx in speech and communication, maintaining good function is a critical aspect in the treatment of glottic cancer. For this reason it has been specifically recommended to initially treat T1 and T2 cases with laryngeal-preserving modalities.[9] In addition, the issue of cost should be considered separately whenever treatment options for glottic cancer are evaluated.[2,3,6] Nevertheless, the primary goal of any treatment for early disease should be cure, and therefore, effectiveness of each modality in reaching this goal should be of prior and highest interest.[3] In this study we retrospectively compared the oncologic outcomes of different surgical approaches for T1 glottic cancer according to our experience. TLM and open, laryngeal-preserving techniques were compared for overall survival and local disease control in T1a and T1b category cases. In addition, the incidence of complications and potential need for tracheotomy among these techniques were assessed. Despite of any differences that were noted, the high total of disease-specific survival and local control rates that were found, irrespective of the technique used, confirm that laryngeal preservation surgery can effectively provide cure for early glottic cancer.

TLM has evolved as an optimal therapy for early and moderately advanced laryngeal carcinomas.[10] TLM represents a minimally invasive surgical approach that allows tumors to be removed with limited sacrifice of healthy tissue and with retention of acceptable voice quality.[11] Functional results of TLM are generally considered superior to those of open surgery and in many cases comparable with radiotherapy.[3,6] Other advantages of TLM include low morbidity and mortality, avoidance of tracheotomy, shorter periods of hospitalization, and low costs.[12,13] In addition, TLM has repeatedly demonstrated cure rates for early laryngeal cancer comparable with those of open surgery or primary radiotherapy.[3,13–17] This therapeutic effectiveness has been confirmed by the present study.

TABLE II.
Type and Incidence of Complications According to Surgical Technique.

Surgical Technique	Total No. (Incidence) of Complications (%)	No. of Cases According to Type of Complication			
		Bleeding	Aspiration	Fistula or Stenosis	Dyspnea
TLM	4 (1.2)	1	1	1	1
Open chordectomy	3 (17.6)		2	1	
Vertical partial laryngectomy	7 (9.4)	1	3	1	2
Frontolateral laryngectomy	3 (13.6)		2		1

TLM = transoral laser microsurgery.

TABLE III.
Incidence and Type of Tracheotomies According to Surgical Technique.

Surgical Technique	No. of Transient Tracheotomies	No. of Permanent Tracheotomies	Total (%)
TLM	0	1	1 (0.003)
Open chordectomy	1		1 (0.06)
Vertical partial laryngectomy	8		8 (11)
Frontolateral laryngectomy	3	1	4 (18)
Total	12	2	14 (0.032)

TLM: transoral laser microsurgery.

The vast majority of either T1a or T1b cases were treated by TLM in this series. A standard piecemeal technique for laser excision is routinely utilized in our institution. This technique allows narrow margin control with maximum preservation of function.[18] The laser is typically used as a cutting instrument rather than one to vaporize the tumor. Frozen section control is necessary as an indicator for further resection, although frozen sections do not always correlate with permanent pathology.[19,20] The significance, nevertheless, of achieving tumor-free surgical margins cannot be overstressed.[20] Unfortunately, although TLM affords increased precision and hemostasis, it may pose serious difficulties for pathologists to reliably assess the status of tumor resection margins.[11,14] On the other hand, TLM may offer easy access to the tumor site for repeated resection whenever dictated by pathology.[3] It is noted, however, that in this series negative histologic margins were achieved in all cases at the end of treatment, regardless of the surgical technique used.

Safe use of CO_2 laser mandates increased awareness and training on behalf of the surgeon and operating room personnel.[3] Airway fire is perhaps the most feared complication, and strict caution against it cannot be overemphasized. Other potential complications include granulomas, bleeding, dyspnea requiring emergency tracheotomy, and aspiration pneumonia.[3] A very low incidence of major complications and related tracheotomies was found for TLM cases in our series. In fact, only a single case of tracheotomy following laser treatment was recorded, almost 20 years ago, due to airway stenosis from postoperative tissue swelling followed by severe granulation tissue formation. Statistical significance was reached for both incidence of complications and need for tracheotomy compared to open surgical techniques. According to the literature, a low incidence of major complications for laser treatment of glottic carcinomas should be expected with the use of laser, especially for T1 lesions where it is reported to be as low as 0%.[21,22]

Several open laryngeal-preserving techniques are available for the treatment of T1 glottic cancer.[3] Laryngofissure with cordectomy includes the resection of a vocal fold through a thyrotomy and is typically indicated for mid-third mobile vocal cord lesions. In our series, 17 (4.5%) T1a cases were treated with this technique. Vertical partial laryngectomy entails removal of up to one half of the larynx and can be used for T1 and T2 lesions without anterior commissure involvement. This technique was utilized in 74 (19.7%) T1a cases in our series. For carcinomas with anterior commissure involvement more aggressive procedures may be utilized.[3] In our series these cases were either treated with laser or a frontolateral partial laryngectomy, which removes a vocal fold, anterior commissure, anterior third of the opposite fold, and the overlying medial thyroid cartilage. Other known transcervical procedures for lesions with anterior commissure involvement, such as the supracricoid laryngectomy,[3] were not assessed in the present study.

As previously mentioned, transcervical techniques showed comparable treatment outcomes with laser surgery. On the other hand, incidence of major complications was significantly higher for these techniques compared to TLM ($P < .001$). Surprisingly, open cordectomy, although less extended, showed the highest incidence of complications among transcervical procedures. Moreover, the need for tracheotomy was significantly higher for open techniques compared to laser surgery ($P < .001$). The majority of these tracheotomies, however, were needed for acute symptomatic relief, and only one was permanently necessary due to intractable aspiration. Pronounced postoperative aspiration for T1 lesions may strike as odd at first, but it is probably related to intraoperative overestimation of the extent of the disease sometimes leading to unnecessarily extended tissue removal. This, according to our results, seems to be more of an issue for open surgical approaches than for laser surgery.

The prognostic significance of anterior commissure involvement in glottic cancer remains controversial.[3] Most authors agree, nevertheless, that anterior commissure involvement pertains a worse prognosis.[23–25] In the present study, disease specific survival was found to be significantly better for cases without anterior commissure involvement ($P = .04$). In addition, a trend towards better local control was noted for these cases, although statistical significance was not reached ($P = .31$). Controversy also exists regarding the optimal treatment modality for cases with anterior commissure involvement. Evidence of local control after radiation therapy is mixed and even contradictory in the literature.[3] Moreover, although laser surgery has been shown to be effective, some authors have found a high rate of recurrences for this specific site, discouraging, therefore, use of lasers.[26,27] Open procedures, on the other hand, have been shown to offer good control of lesions involving the anterior commissure at a cost of poorer functional outcome.[28] In our series, open partial procedures failed to show superior oncologic results compared with laser surgery for such cases. Moreover, disease specific survival was nearly the same for patients undergoing TLM either with (97.7%), or without (97.4%), anterior commissure involvement. Local control, however, was superior for cases without anterior commissure involvement (95.3% vs. 93.8%), although rates remained comparable ($P = .406$).

CONCLUSION

TLM appears to be a very effective treatment modality for T1 glottic cancer. It offers results comparable with open surgery with a lower incidence of complications and a very rare need for tracheotomy. Prospective, double-blinded, randomized studies are still necessary in order to objectively compare all available treatment modalities for early glottic cancer. The previously mentioned outcomes, nevertheless, in addition to other well-established advantages of TLM, such as good functional result and low cost, make this technique the preferred surgical treatment option for T1 glottic cancer. A transcervical approach should be reserved only for cases where individual anatomic factors do not permit complete tumor exposure during diagnostic microlaryngoscopy.

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