

Oncological Outcome of Transoral Laser Surgery in Laryngeal Carcinomas

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Abstract

The principles of treatment of laryngeal carcinoma have undergone changes over the last few years and can be very complex with early (I-II) and advanced (III-IV) stage diseases to be differentiated. Recent emphasis is on organ preservation and laryngeal function. Transoral CO₂ laser surgery has become a standard surgical procedure not only in early stage I and II laryngeal carcinomas but also in advanced stage III cases in combination with postoperative adjuvant radiochemotherapy. This retrospective study reflects the role of transoral laser surgery as a single or multimodality treatment regime with neck dissection and postoperative radiochemotherapy in laryngeal carcinomas.

From January 1997 to February 2007, 239 patients (215 men and 24 women; mean age 61 years) were examined with laryngeal squamous cell carcinoma (stage I-IV). 220 out of these 239 patients underwent transoral laser surgery, depending on their tumor stage either as a single or as a multimodality treatment regimen in combination with bilateral neck dissection and postoperative radio-chemotherapy. Thirteen patients underwent a transcervical tumor resection, 5 patients underwent radiochemotherapy alone and one patient refused a treatment of his tumor disease. Median follow-up time was 60 months.

The 5-year overall survival rate of the 220 patients who were treated with laser surgery was 86%. The 5-year recurrence-free survival rate was 69.5%. After laser surgical interventions, postoperative complications occurred in 16%.

The oncological outcome of transoral laser surgery as a single mode in early laryngeal carcinomas or in combination with bilateral neck dissection and postoperative adjuvant radiochemotherapy in advanced tumor stages is satisfying if clean surgical tumor margins (R₀) can be reached. If tumor-free margins cannot be achieved (R₁ and R₂ resection) and transoral revision is not possible, transcervical procedures (total or partial laryngectomy) must be considered.

Keywords Laryngeal carcinoma, transoral laser surgery, radiochemotherapy.

INTRODUCTION

Transoral carbon dioxide (CO₂) laser surgery in Otorhinolaryngology for tumors of the upper aerodigestive tract has gained increasing importance over the past few years.¹⁻⁴ In literature, most publications focus on the use of transoral laser resections in the treatment of benign laryngeal lesions and early stage malignant tumors (stage I) of the larynx with excellent control rates and preservation of function.^{1,5-9}

For advanced laryngeal carcinomas which have a much worse prognosis different multimodality treatment regimens are discussed in the literature. The oncological results of these therapy methods have been presented in numerous studies, some with large case loads.¹⁰⁻¹³ However, neither surgery nor radiochemotherapy alone have been able to produce satisfactory results. Experience seems to indicate that combined surgery and radiochemotherapy offer a better chance for cure, especially in advanced laryngeal

carcinomas.^{4,14} Apart from combined radiochemotherapy, total pharyngolaryngectomy with neck dissection and postoperative irradiation is regarded as standard therapy for resectable stage III and IV squamous cell carcinoma of the larynx.^{15,16} The value of CO₂ laser resections of advanced laryngeal cancers is gaining more and more importance as the preservation of laryngeal structures enables a better quality of life for the patient.¹⁷⁻²⁰ This retrospective study reflects the role of transoral laser surgery as a single or multimodality treatment regimen with neck dissection and postoperative radiochemotherapy in laryngeal carcinomas.

PATIENTS AND METHODS

From January 1997 to February 2007, 220 patients with laryngeal squamous cell carcinoma were treated with transoral laser surgery as a single treatment modality in early (I and II) tumor stages or as a multimodality treatment modality with neck dissection and postoperative adjuvant

radiochemotherapy in advanced (III and IV) laryngeal tumor stages at the Department of Otolaryngology, Head and Neck Surgery, University Hospital of Mannheim, Germany. In respect to oncological radicality, transoral laser surgery was performed if the tumor was completely exposable which was judged during the preceding diagnostic panendoscopy-meaning microlaryngos-copy, bronchoscopy and esophagoscopy-with multiple biopsies. Consequently, the decision for or against laser surgery was based on the results of endoscopy and the accessibility of the tumor for the laser. Patients with a secondary malignant tumor, and patients with recurrent tumor or distant metastases were excluded from the study.

The retrospective study enrolled 202 male and 18 female patients with a laryngeal carcinoma, the mean age being 59 years (range, 41-88 years). Stage distribution of the patients was as follows: Stage I, 50%; Stage II, 25%; Stage III, 12%; Stage IV, 13% according to the Union International Contre le Cancer 2002 (UICC) staging system. Table 1 shows the clinicopathological characteristics of the tumors studied. Thus, 75% of the patients were assigned to the group of early glottic cancers (Stages I and II). All patients with early laryngeal carcinoma underwent transoral microsurgical CO₂ laser resection of the primary tumor as a single treatment modality, patients with advanced laryngeal carcinomas underwent additionally a bilateral neck dissection in combination with a radiochemotherapy. Residual tumors were classified according to UICC definitions: R_x, the presence of residual tumor could not be assessed; R₀, no residual tumor; R₁, microscopic residual tumor; R₂, macroscopic residual tumor. An R₀ resection was the general objective. Due to the large size of the primary tumor and suspected cervical lymph node metastasis the patients underwent selective bilateral neck dissection. The postoperative adjuvant radiochemotherapy was performed three weeks after surgery with a radiation dose of up to 66 Gy (boost treatment of the primary tumor). The endoscopic laser resections were performed under general anesthesia with an Heraeus LS 500 CO₂ laser connected to a Zeiss operating microscope and a micromanipulator. The CO₂ laser was used as a cutting device providing a 0.3 mm spot size for a working distance of 400 mm in a continuous mode. The statistical evaluation of the data was performed with a software program (Winstat 4.0 for MS-Dos Windows). For survival analyses the Kaplan-Meier method and the log-rank test were used.

RESULTS

In 188 (85.5%) of 220 patients, a R₀ resection was achieved with transoral laser surgery. In the final histopathological examinations of the resected specimens, positive tumor margins were microscopically detected (R₁) in 7 patients (3%). In one patient a tumor was retained macroscopically (R₂). In 26 patients (12%), no definite R classification could be yield (R_x). Tumor stage in relation to the R classification are demonstrated in Table 2.

Postoperative recovery was without significant complications in 185 (84%) out of 220 patients. In 35 patients, postoperative complications were observed within the first two weeks after surgery. Ten patients suffered from dyspnea and required an additional tracheostomy. Thirteen patients had a bleeding 5 to 8 days after laser surgery and needed a revision surgery and 12 patients developed a synechia which needed to be cut through.

During the 60 months median follow-up time, 64 patients (29%) developed local recurrences. In 45 of these 64 patients even regional recurrences at the neck site were observed. In relation to the R classifications, 7 of the 64 patients were initially R₁ resected, 1 patient was R₂ resected, 26 patients were R_x resected and 30 patients were R₀ resected. Patients with local recurrences (8/64) underwent laryngectomy as "salvage surgery". These patients were initially R₁ and R₂ resected and remained recurrence free after salvage surgery. In patients with local and regional

Table 1. Distribution of the T and N categories of all patients undergoing laser resection (n = 220)

TN	N0	N1	N2a	N2b	N2c	N3	Total
T ₁	110	0	0	0	1	0	111
T ₂	55	0	1	1	1	0	58
T ₃	24	2	1	0	0	1	28
T ₄	19	0	1	1	2	0	23
Total	208	2	3	2	4	1	220

Table 2. Tumor stage in relation to the R-classification of all laser resections (n = 220)

	Stage I	Stage II	Stage III	Stage IV	Total
R ₀	110	55	19	2	186
R ₁	0	0	3	4	7
R ₂	0	0	0	1	1
R _x	0	0	7	23	26
Total	110	55	26	29	220

recurrences (43/64) of their early stage (I and II) tumor a second, more advanced laser resection was performed, patients with advanced tumor stages who rejected a salvage surgery underwent (13/64) chemotherapy.

Figure 1 demonstrates the five-years overall survival rate of patients with laser surgical resections which was 86%. This is equal to 189 out of 220 patients. The 5-year recurrence-free survival rate was 69.5% (Fig. 2).

DISCUSSION

Only limited data are available on the use of laser surgery in advanced laryngeal carcinomas. Most of the publications focus on CO₂-laser surgery in the management of early stage T₁ and T₂ cancers of the larynx.⁵⁻⁹ In spite of aggressive radical surgery including total laryngectomy, the

prognosis of advanced laryngeal carcinomas is very poor.¹⁷ The preservation of functionally important organ structures in the larynx is gaining increasing importance in tumor surgery of advanced carcinomas in order to improve the patients' quality of life.¹⁷⁻¹⁹ Iro et al describe their experiences with CO₂-laser surgery in 141 patients with supraglottic carcinomas retrospectively.²⁰ In the study, the median follow-up of the patients was 37 months. The patients underwent laser surgery combined with neck dissection in cases with lymph node metastases or suspected lymph node involvement. According to the UICC classification 51% of the tumors were stage III and IV. The recurrence-free survival rate three years after surgery was 76 and 65.7% five years after surgery respectively. The local and regional recurrence rate were 16.3 and 9.9%. An R₀ resection could be achieved in 78% of the patients. Patients with R₁ or R₂ resections underwent radiotherapy where revision surgery was refused by the patient. In spite of irradiation the local recurrence rate in these patients was 26%. Iro et al recommend a combined treatment modality with laser surgery and postoperative irradiation in advanced laryngeal carcinomas as irradiation after surgical failure did not have a significant positive effect on the patients prognosis.

In 1996, Steiner et al published the results of laser surgery in 99 patients with supraglottic cancer.^{18,19} In 56 patients with stages III and IV cancer, the 5-year overall survival rate was 48.8% with a local recurrence rate of 19.5%.

Since many years, we are using the CO₂-laser in the treatment of benign lesions of the larynx and early stage T₁ and T₂ malignant tumors of the larynx with excellent control rates and preservation of the function.⁶⁻⁸ In advanced laryngeal carcinomas, we recommend the use of laser surgery in a combined treatment modality with postoperative radio-chemotherapy as surgery or radiotherapy alone do not achieve promising control rates.¹⁰⁻¹³ Laser surgery in combination with postoperative radiochemotherapy seems appropriate in patients with histologically proven R₀ resections yielding a promising 5-year survival rate of 86%. Regarding the worse prognosis in patients with R₁ resections where R₀ resections could not be achieved by means of transoral surgery, we recommend transcervical procedures such as partial or total laryngectomy. All patients in our study who were initially R₁ resected and underwent total laryngectomy remained recurrence free after the second operation.

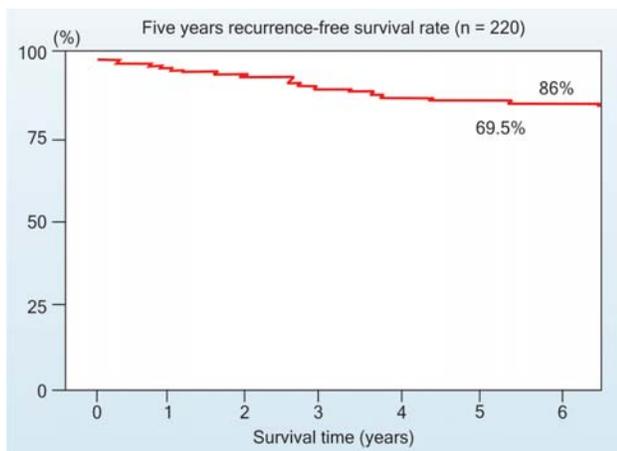


Fig. 1: Five years overall survival rate of 220 patients with laryngeal carcinomas undergoing laser surgery



Fig. 2: Five years recurrence-free survival rate of 220 patients with laryngeal carcinomas undergoing laser surgery

In 16% of all laser surgically treated patients we observed postoperative complications. This low rate of complications after CO₂ laser surgery of advanced laryngeal cancer is in line with the findings of Iro et al and our own previous findings.^{20,21} The main causes of death were local and regional recurrences as well as secondary tumors in the region of the esophagus and oropharynx. Even these results confirm the analysis of previous studies on the follow-up of patients with advanced laryngeal cancer following CO₂ laser surgery.^{17,19-21}

Our results reflect a long-term overview on the oncological outcome of CO₂ laser surgery in patients with laryngeal carcinomas with a 5-year overall survival rate of 86%. These results are encouraging and suggest laser surgery as a promising treatment alternative to radical surgery in a combined treatment modality providing “organ-preservation”. However, further multicentral studies are necessary to determine the role and value of laser surgery in advanced laryngeal carcinomas.

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