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Original Citation:

Availability:

This version is available at: 11577/1772398 since:

Publisher:

LIPPINCOTT WILLIAMS & WILKINS, 530 WALNUT ST, PHILADELPHIA, PA 19106-3621 USA

Published version:

DOI: 10.1097/MLG.0b013e31815a9ed3

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Long-Term Quality of Life After Total Laryngectomy and Postoperative Radiotherapy Versus Concurrent Chemoradiotherapy for Laryngeal Preservation

Paolo Boscolo-Rizzo, MD; Francesca Maronato, MD; Carlo Marchiori, MD; Alessandro Gava, MD; Maria Cristina Da Mosto, MD

Objective: To compare the quality of life (QoL) of patients who underwent total laryngectomy with voice prosthesis insertion and postoperative radiotherapy (PORT) with those receiving concurrent chemoradiation for laryngeal preservation.

Study Design: Retrospective, cross-sectional study in a tertiary academic center.

Methods: The European Organization for Research and Treatment of Cancer Quality of Life Questionnaires were used to assess long-term QoL in 67 patients treated for laryngeal cancer.

Results: The scores of functional scales for physical ($P < .000$), social ($P = .001$), and role functioning ($P = .043$) were more favorable in the chemoradiation group. The global QoL score was higher in the nonsurgical group ($P = .016$). Surgical patients reported on sleep disturbance ($P < .000$), dyspnea ($P = .001$), and pain ($P = .003$), with a higher scores and greater difficulties with the senses ($P < .000$), social contact ($P = .002$) and speech ($P = .010$). The chemoradiation group reported greater problems with dry mouth ($P < .000$) and sticky saliva ($P = .005$).

Conclusion: We found better long-term QoL scores in patients undergoing concurrent chemoradiation. This appears to be mainly because of better physical functioning, social functioning, and social contact and smaller problems with pain, respiration, speech, the senses, and sleep disturbances.

Key Words: European Organization for Research and Treatment of Cancer Quality of Life Questionnaires, larynx cancer, quality of life, total laryngectomy.

Laryngoscope, 118:300–306, 2008

INTRODUCTION

Laryngeal cancer is the most common malignant tumor of the upper aerodigestive tract. Surgical treatment of advanced laryngeal cancer often requires a total laryngectomy (TL), resulting in a permanent tracheostomy and potential difficulties with a patient's speech and communication. Therefore, there has been significant effort in the improvement of organ preservation therapies such as partial reconstructive surgery, radiation therapy alone, induction chemotherapy, or concurrent chemoradiotherapy.

Chemoradiation organ preservation strategies have demonstrated that some larynges can be saved without compromising overall survival. In 1991, the Department of Veterans Affairs Laryngeal Cancer Study Group investigated whether induction chemotherapy and definitive radiation therapy with laryngectomy reserved for salvage represented a better initial treatment approach for patients with advanced laryngeal cancer than TL with postoperative radiation therapy. The conclusion was that induction chemotherapy and definitive radiation therapy can be effective in preserving the larynx in a high percentage of patients without compromising overall survival.¹

In 2003, a randomized trial was published on concurrent chemoradiotherapy for laryngeal preservation.² This trial was updated at the 2006 American Society of Clinical Oncology annual meeting, and the findings confirmed the previous results: the 5-year laryngeal preservation rate was significantly better with concurrent chemoradiotherapy (83.6%) compared with induction chemotherapy (70.5%) or

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Editor's Note: This Manuscript was accepted for publication September 7, 2007.

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DOI: 10.1097/MLG.0b013e31815a9ed3

radiotherapy (RT) alone (65.7%), without differences recorded in overall or disease-free survival.³

In addition, results of the “Meta-Analysis of Chemotherapy in Head and Neck Cancer” showed that concurrent chemoradiotherapy resulted in a significant 8% benefit in 5-year survival compared with RT alone, whereas adjuvant and induction chemotherapy did not improve survival.⁴ Consequently, concurrent chemoradiotherapy appears to be the most reasonable approach to preserve the larynx in patients with advanced laryngeal cancer.

However, concurrent chemoradiation is associated with significant acute and late toxicities because of its radiosensitization effects such as frequently occurring severe mucositis that prevents oral feeding, leading to significant weight loss and often requiring a break in the radiation treatment.⁵ In addition, radiation induces profound hypofunction of salivary gland tissue with consequent xerostomia, a major cause of distress. Furthermore, TL after failure of concurrent chemoradiation therapy is associated with high complication rates because of wound-healing difficulties.⁶

Posttreatment quality of life (QoL) is a decisive factor in choosing between different therapies that give comparable results. Physicians should be aware of long-term QoL differences when they counsel patients.

Only a few studies have compared QoL outcomes between patients undergoing TL and postoperative radiotherapy (PORT) and patients receiving concurrent chemoradiation for laryngeal preservation. The purpose of this study was to compare the long-term QoL of patients undergoing TL and PORT with those undergoing concurrent chemoradiation for laryngeal preservation using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaires (EORTC-QLQ).^{7,8}

PATIENTS AND METHODS

Patients

At the ENT Department and Regional Center for Head and Neck Cancer, University of Padua, Treviso Regional Hospital, treatment planning of laryngeal cancer is mainly based on TNM staging. Most T1 and T2 cancers are treated with conservative surgery or exclusive RT; on the other hand, most patients with T3 or T4 cancer undergo TL with neck dissection and primary voice prosthesis insertion followed by PORT or concurrent chemoradiotherapy. Surgery is generally preferred for tumors that deeply infiltrate the larynx or destroy the cartilage. In other cases, the decision to choose between these two reasonable alternatives is based generally on patient preferences.

PORT was performed using 4 to 6 MV photons from a linear accelerator administered in 2 Gy daily fractions applied five times weekly. All patients were immobilized with a thermoplastic mask. A volume encompassing the primary site and all draining lymph nodes at risk was prescribed to receive a dose of 60 Gy in 30 fractions over a period of 6 weeks. No patients underwent intensity-modulated radiotherapy (IMRT).

Patients who underwent concurrent chemoradiotherapy were prescribed to receive a dose of 66 to 70 Gy in 33 to 35 fractions over a period of 7 weeks. All patients in this group received at least two cycles of chemotherapy concurrently with RT. The chemotherapeutic regimen included cis-platinum 100 mg/m² on day 1 and 5-fluorouracil 1,000 mg/m² as a continuous infusion on days 1 to 5.

The spinal cord dose was limited to a maximum of 46 Gy. Both sides of the neck were prescribed to receive a boost of electrons with a dose of 4 Gy in N0 and 14 Gy in N+ cases. The criteria of inclusion were 1) complete remission after TL plus RT or chemoradiotherapy for laryngeal or hypopharyngeal-laryngeal carcinoma, 2) treatment completed at least 24 months prior to inclusion in the study.

The questionnaires were submitted to the patients at the time of a surveillance visit and labeled with the patient's nondescriptive letter identifier. Physicians were not present when patients filled out the questionnaires. A medical student was always available to support the patients in filling out the questionnaires.

QoL Measures

The EORTC-QLQ was used to assess QoL outcomes. The EORTC Quality of Life Questionnaire-Core 30 (QLQ-C30) incorporates 30 items and consists of 5 functional scales (physical, role, cognitive, emotional, and social functioning), 3 symptom scales (fatigue, pain, and nausea/vomiting), a global QoL scale, and 6 single items (dyspnea, insomnia, appetite, constipation, diarrhea, and financial impact).⁷

The EORTC Quality of Life Questionnaire-Head and Neck 35 (QLQ-H&N35) is a supplement module to the QLQ-C30 and consists of items used for assessing QoL for head and neck cancer patients.⁸ It incorporates 35 questions making up 7 multiple-item symptom scales (pain, swallowing ability, taste/smell, speech, social eating, social contact, and sexuality) and 11 single-item scales, which assess the presence of symptomatic problems related to the teeth, mouth opening, dry mouth, sticky saliva, coughing, feeling ill, use of painkillers, use of nutritional supplements, feeding tube, weight loss, and weight gain.

All scales pertaining to the EORTC QLQ-C30 and QLQ-H&N35 range from 0 to 100. A high score for a functional or global QoL scale represents a relatively high/healthy level of functioning or global QoL, whereas a high score for a symptom scale indicates a higher level of symptoms or problems. The institutional review board approved the protocol of this study.

Statistic Analysis

Fisher's exact test and Student *t* test were used to assess group differences on clinical data. The scores of the QoL were calculated according to the EORTC-QLQ scoring manual. Non-parametric Wilcoxon rank sum analysis was used to test for differences between surgery and chemoradiation groups on the EORTC scales.

Survival was calculated from the date of the end of treatment and was analyzed using the standard Kaplan-Meier method. Tests of significance were based on log-rank statistic.

Tests were two tailed, and levels of statistical significance have been calculated at the 5% level of probability. Statistical analysis was performed using the SPSS/PC software package (SPSS, Inc., Chicago, IL).

RESULTS

Clinical Data

Of 112 consecutive patients with advanced laryngeal cancer treated at our center between January 2001 and November 2004 and identified for possible inclusion in the analysis, 5 were lost to follow-up, 26 were dead, 9 were alive with disease, and 72 were still alive without evidence of disease at the time of data collection (January 2005–November 2006). The median follow-up for surviving patients was 37.5 (range, 3–51) months. Survival was not

statistically different between the two groups ($P = .267$, log-rank test) (Fig. 1). Actuarial overall survival at 3 years was 78.3% (95% confidence interval [CI], 68.8–87.8%) and 76.9% (95% CI, 66.2–87.6%) in the surgery group and the chemoradiation group, respectively. The cumulative 3-year complete laryngeal preservation rate in the chemoradiotherapy group was 90.9% (95% CI, 83.9–97.9%).

Sixty-seven of 72 eligible patients completed the QoL questionnaires. One patient refused to complete the survey. Four patients who underwent salvage surgery after failure of chemoradiotherapy were excluded from this study. Clinical data and treatment are shown in Table I. The two groups did not differ significantly with respect to age, sex, T category, tumor stage, tumor site, and average time of QoL assessment. A TL with partial pharyngectomy was performed in seven patients. Five patients of the chemoradiotherapy group underwent temporary tracheostomy. Prophylactic placement of a feeding tube was performed in all patients who underwent chemoradiotherapy. At the time of data collection, no patients who underwent chemoradiotherapy depended on a tracheostomy; on the other hand, one patient of the surgery group and two patients of the chemoradiotherapy group still had gastrostomy feeding tubes.

EORTC QLQ-C30

The results from the EORTC QLQ-C30 are shown in Table II. The scores of for the functional scales for physical ($P < .000$; mean difference = 20.1), social ($P = .001$; mean difference = 14.3), and role functioning ($P = .043$; mean difference = 8.2) were significantly more favorable in the chemoradiation group. The global QoL score was higher in the nonsurgical group ($P = .016$; mean difference = 11.1).

Also, surgical patients gave higher scores for sleep disturbance ($P < .000$; mean difference = 20.2), dyspnea ($P = .001$; mean difference = 18.0), and pain ($P = .003$; mean difference = 10.6) than nonsurgical patients.

EORTC QLQ-H&N35

The results from the EORTC QLQ H&N35 are shown in Table III. Surgical patients reported significantly greater difficulties with the senses ($P < .000$; mean difference = 33.8), social contact ($P = .002$; mean difference = 17.9), and speech ($P = .010$; mean difference = 16.5); furthermore, surgical patients felt more ill than chemoradiation patients did ($P = .019$; mean difference = 10.8). Conversely, the chemoradiation group reported significantly greater problems with dry mouth ($P < .000$; mean difference = 38.7), the teeth ($P < .000$; mean difference = 34.0), and sticky saliva ($P = .005$; mean difference = 21.7).

DISCUSSION

QoL refers to “global well-being,” including physical, emotional, mental, social, and behavioral components. The assessment of QoL in cancer patients has become an increasingly important issue in oncology. In the last few years, a number of informative and valid QoL tools has become available to measure health-related QoL. General QoL instruments assess the overall impact of patients’ health status on their QoL and can be used for all types of cancer patients; on the other hand, cancer-specific instruments assess the impact of a specific cancer on QoL.

In this study, the EORTC QLQ-C30 together with the head and neck cancer-specific QLQ-H&N35 module were chosen to evaluate QoL in patients treated for laryngeal cancer. EORTC QLQ-C30 is among the most used QoL

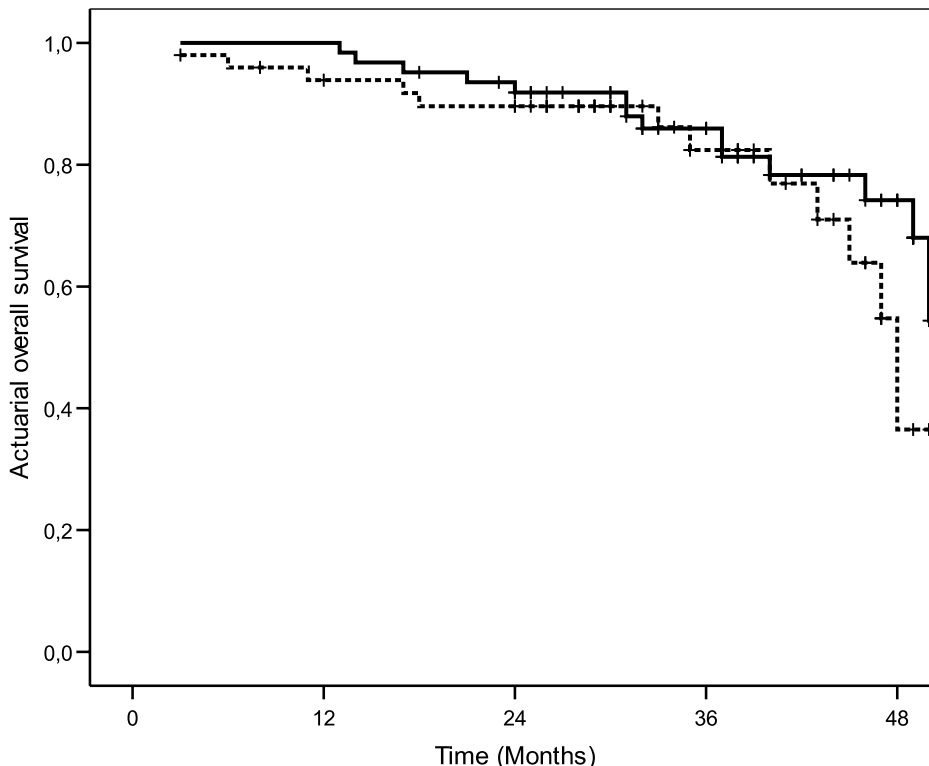


Fig. 1. Actuarial overall survival of all 112 patients with advanced laryngeal cancer. The solid line represents patients who underwent total laryngectomy and postoperative radiotherapy ($n = 62$), whereas the broken line represents patients who received concurrent chemoradiotherapy ($n = 50$). The difference was not significant ($P = .271$, log-rank test).

TABLE I.
Clinical Data and Treatment.

	Total Laryngectomy + PORT (n = 39)	Chemoradiotherapy (n = 28)	P Value
Sex (%)			
Male	34 (87.2)	24 (85.7)	1.000
Female	5 (12.8)	4 (14.3)	
Mean age, yr (range)	61.4 (39–82)	62.4 (37–73)	.708
T			
T2	9	5	.780
T3	20	15	
T4	10	7	
Stage (%)			
III	26 (66.7)	18 (64.3)	1.000
IV	13 (33.3)	10 (35.7)	
Site			
Laryngeal	32	21	.550
Hypopharyngeal-laryngeal	7	7	
Neck dissection			
Yes	33	4	<.000
No	6	24	
Indwelling voice prosthesis (%)			
Yes	39 (100)	—	
No	0 (0)	—	
Mean time of QoL evaluation from end of treatment, mo (range)	30 (24–39)	29 (24–35)	.305

PORT = postoperative radiotherapy; QoL = quality of life.

instruments because of its high specificity, reliability, and validity. Recently, the validity and reliability of an Italian version of the EORTC QLQ-H&N35 was confirmed in laryngeal cancer patients.⁹

The results of the present analysis show some differences in QoL outcomes between the groups. In this study, patients who underwent TL reported significantly more impaired physical, social and role functioning, and social contact scores. This finding confirms the trend observed in other series.^{10,11} The head and neck region is highly significant in terms of body image because of its visibility and prominence. When disfigurement occurs as a consequence of TL, QoL may be profoundly and adversely affected; physical, social, and psychological well-being are deeply influenced by a disrupted body image and dysfunction consequential to treatment.^{10,12} There is a significantly higher impact by the most extensive disfigurement versus minor disfigurement as regards changed patient self-image, a worsened relationship with a partner, reduced sexuality, and increased social isolation.¹² Furthermore, some authors conclude that a definitive tracheostomy has a negative impact on adjustment post-operatively and that it may have a more severe impact on QoL than loss of voice.

In respect to this issue, lack of psychological support may result in adjustment difficulties after mutilating head and neck surgery. Hammerlid et al.¹³ reported that head and neck cancer patients can benefit from psychosocial interventions; above all, psychiatric morbidity, social

functioning, emotional function, and global QoL were reported to improve in patients undergoing psychological group therapy.

Patients treated with TL reported significantly greater problems with breathing and sleeping. TL precludes nasal air conditioning. As a consequence, inhaled air can cause irritation of the bronchial mucosa, coughing, excessive daily sputum production, and crusting, requiring frequent forced expectoration and frequent stoma cleaning. These respiratory problems correlate with several aspects of daily living, including sleeping.¹⁴

Because of the long-term nature of this study, acute pain caused by acute adverse effects of chemoradiotherapy has not been evaluated. Chronic pain after surgery for head and neck cancer is not uncommon, and it is frequently a consequence of neck dissection. Chronic shoulder pain after neck dissection may be caused by injury of cervical nerves, by musculoskeletal imbalance, and by associated changes occurring in the shoulder after removal of neck muscles or a spinal accessory nerve.¹⁵ No statistically significant differences between the groups were found when pain was measured by the EORTC QLQ-H&N35. This may be because, in the surgical group, pain was mainly localized to the neck and shoulder, whereas pain evaluation in the EORTC QLQ-H&N35 is determined by painful symptoms in the mouth, jaw, and throat.

In the present study, the global QoL score was significantly higher in patients who underwent concurrent

TABLE II.
Results From European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Core 30.

	TL With VP + PORT, Median (range)	Mean (95% CI)	Chemoradiotherapy, Median (range)	Mean (95% CI)	P Value
Physical functioning	75.0 (33–100)	75.8 (69.7–81.9)	100.0 (80–100)	95.9 (93.3–98.5)	<.000
Role functioning	100.0 (33–100)	87.6 (81.3–93.9)	100.0 (50–100)	95.8 (90.7–100.0)	.043
Social functioning	83.3 (33–100)	80.3 (73.3–87.3)	100.0 (66–100)	94.6 (89.9–99.3)	.001
Emotional functioning	83.3 (25–100)	76.9 (70.4–83.3)	87.5 (58–100)	85.1 (79.9–90.3)	.118
Cognitive functioning	100.0 (33–100)	88.9 (82.2–93.8)	100.0 (83–100)	90.8 (86.4–96.3)	.403
Global QoL	75.0 (33–100)	75.8 (69.7–81.9)	87.5 (67–100)	86.9 (82.3–91.5)	.016
Fatigue	0.0 (0–67)	14.3 (7.9–20.5)	22.2 (0–56)	16.2 (10.5–22.1)	.408
Nausea and vomiting	0.0 (0–17)	1.7 (0.1–3.4)	0.0 (0–17)	1.2 (0.0–2.9)	.662
Pain	0.0 (0–67)	12.4 (6.2–18.6)	0.0 (0–17)	1.8 (0.0–3.8)	.003
Dyspnea	33.3 (0–67)	23.9 (16.5–31.3)	0.0 (0–33)	5.9 (0.9–11.0)	.001
Sleep disturbance	33.3 (0–100)	21.4 (13.3–29.4)	0.0 (0–33)	1.2 (0.0–3.6)	<.000
Appetite loss	0.0 (0–67)	5.9 (1.1–10.9)	0.0 (0–67)	14.3 (5.4–23.2)	.093
Diarrhea	0.0 (0–67)	3.4 (0.0–7.6)	0.0 (0–33)	7.1 (1.8–12.5)	.122
Constipation	0.0 (0–67)	16.2 (7.3–25.1)	0.0 (0–67)	16.6 (9.2–24.1)	.451
Financial impact	0.0 (0–100)	12.8 (4.0–21.6)	0.0 (0–67)	16.7 (7.7–25.6)	.224

TL = total laryngectomy; VP = voice prosthesis; PORT = postoperative radiotherapy; CI = confidence interval.

chemoradiotherapy. This result agrees with Terrel et al.¹¹ who assessed QoL in long-term survivors of the Veterans Affairs Laryngeal Cancer Study population and demonstrated that patients who were randomized to the chemoradiation arm tended to have a better QoL as measured by the Medical Outcome Studies Short-Form 36 general health survey with respect to pain, emotional well-being, and depression.

On the other hand, Hanna et al.,¹⁰ using EORTC questionnaires, failed to find significant differences in

overall QoL scores between patients who underwent TL and patients treated with concurrent chemoradiotherapy. A possible explanation for this is that the average time of QoL evaluation from the end of treatment was only 15 months, with 25% of patients evaluated within 1 year after treatment. Short-term adverse effects of concurrent chemoradiotherapy may have a greater impact on QoL.

Organ preservation strategies have the evident advantage of avoiding sacrifice of the larynx. However, aggressive chemoradiotherapy treatment is associated

TABLE III.
Results From European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Head and Neck 35.

	TL With VP + PORT, Median (range)	Mean (95% CI)	Chemoradiotherapy, Median (range)	Mean (95% CI)	P Value
Pain	0.0 (0–50)	6.4 (2.5–10.3)	0.0 (0–8)	3.3 (1.7–4.9)	.928
Swallowing	8.3 (0–75)	14.5 (8.2–20.8)	8.3 (0–33)	9.5 (5.7–13.3)	.677
Senses	33.3 (0–100)	42.1 (32.5–51.7)	0.0 (0–33)	8.3 (2.6–14.0)	<.000
Speech	22.2 (0–100)	26.0 (17.1–34.9)	0.0 (0–78)	9.5 (1.8–17.3)	.010
Social eating	8.3 (0–83)	13.9 (7.2–20.5)	0.0 (0–58)	10.7 (2.9–18.5)	.130
Social contact	6.7 (0–100)	22.6 (11.7–33.4)	0.0 (0–53)	4.7 (0.0–10.1)	.002
Sexuality	16.7 (0–100)	34.6 (22.7–46.5)	16.7 (0–100)	22.0 (10.0–33.9)	.204
Teeth	0.0 (0–67)	7.7 (1.9–13.4)	33.3 (0–100)	41.7 (27.8–55.6)	<.000
Open mouth	0.0 (0–67)	5.9 (0.5–11.4)	0.0 (0–33)	9.5 (3.6–15.4)	.149
Dry mouth	0.0 (0–100)	13.7 (5.6–21.8)	33.3 (0–100)	52.4 (40.0–64.8)	<.000
Sticky saliva	0.0 (0–100)	18.8 (9.9–27.7)	33.3 (0–100)	40.5 (27.6–53.3)	.005
Coughed	0.0 (0–100)	17.9 (9.7–26.0)	16.7 (0–67)	17.8 (10.4–25.3)	.616
Felt ill	0.0 (0–100)	11.1 (3.1–19.0)	0.0 (0–8)	0.3 (0.0–0.9)	.019
Painkillers	0.0 (0–100)	15.4 (3.5–27.2)	0.0 (0–100)	10.7 (0.0–22.9)	.583
Nutritional supplements	0.0 (0–100)	2.5 (0.0–7.5)	0.0 (0–100)	10.7 (0.0–22.9)	.168
Feeding tube	0.0 (0–100)	2.5 (0.0–7.8)	0.0 (0–100)	7.1 (0.0–17.3)	.375
Weight loss	0.0 (0–100)	15.3 (3.5–27.2)	0.0 (0–100)	10.7 (0.0–22.9)	.583
Weight gain	0.0 (0–100)	41.0 (24.8–57.2)	0.0 (0–100)	32.1 (13.7–50.6)	.462

TL = total laryngectomy; VP = voice prosthesis; PORT = postoperative radiotherapy; CI = confidence interval.

with significant toxicity and morbidity that can cause chronic laryngeal speech impairment.⁵ Finizia and Bergman¹⁶ reported that successful speech rehabilitation with voice prosthesis may be as effective as conservative treatment with RT alone as measured with generic QoL instruments.

Prosthetic voice satisfaction rates in the literature are reported as varying from 40% to 90%.¹⁷ In our patients, the overall rate of successful rehabilitation with voice prostheses as measured by the Harrison-Robillard-Schultz Rating Scale¹⁸ was approximately 80%. However, patients who have undergone TL experienced significantly greater difficulties with speech than chemoradiation patients. Patients with tracheoesophageal puncture may have difficulty in accepting a low-pitched voice that is unrecognized as their own. Kazi et al.¹⁹ found age and sex to be significant predictors of QoL speech scores, with higher scores in older patients and women. This was related to the impact of vocal dysfunction on the working and social life of younger patients and the low acceptance of low-pitched voices with consequential psychosocial and gender identification problems in women. Interestingly, 38.5% (15 of 39 patients) of surgical patients considered their voice as optimal.

In previous studies, surgical patients reported significantly greater difficulties with the senses than chemoradiation patients. TL results in a permanent disconnection of the upper and lower airways, so olfactory impairment is obvious in these patients. In addition, because most tastes are dependent on retronasal stimulation of the olfactory receptors, patients may also have taste disorders.²⁰

Dry mouth and sticky saliva are the most troublesome long-term adverse effects of chemoradiotherapy reported in these studies.^{5,21} Our data confirm that chemoradiation patients reported significantly greater problems with dry mouth, the teeth, and sticky saliva than patients undergoing TL and PORT.

This may be caused by the enhanced radiosensitization effects of chemotherapy, a more extended radiation field, and a slightly higher dose of radiation therapy. In this setting, the addition of amifostine may improve QoL. Recently, a comprehensive meta-analysis concluded that amifostine significantly prevents xerostomia in head and neck cancer patients.²¹ In patients with laryngeal and hypopharyngeal cancer, xerostomia mainly depends on the irradiation of the nodal volume, which often lies in close proximity to the parotid glands. Salivary gland-sparing IMRT was demonstrated to reduce observer-assessed and patient-reported xerostomia compared with that expected after standard RT.²²

The nonrandomized, cross-sectional nature of this study may limit the applicability of our results. Furthermore, because therapy was not standardized, treatment preferences could have biased the results.

However, all patients were evaluated as regards QoL at least 24 months after treatment, and there were no significant differences in the timing of the analyses between groups. Nevertheless, future prospective, clinical trials are desirable.

CONCLUSION

Despite discomfort related to sticky saliva and dry mouth, we found better long-term QoL scores in patients undergoing concurrent chemoradiation for laryngeal preservation compared with patients treated with TL and PORT for advanced laryngeal cancer. This appears to be mainly caused by better physical, social functioning, and social contact scores and smaller problems with pain, respiratory, speech, the senses, and sleep disturbances. In our opinion, in light of the comparable survival rates, high laryngeal preservation rates, and better long-term QoL, a larynx-preservation approach with concurrent chemoradiotherapy should always be considered in patients with advanced laryngeal cancer without tumor invasion through the cartilage into soft tissues. However, it should be considered that TL after failure of concurrent chemoradiation therapy is associated with higher surgical complication rates.²³ Obtaining proper informed consent is thus mandatory.

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