

# Treatment of laryngeal cancer: rationale and outcomes

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## ABSTRACT

### Objectives:

1. Evaluate the rationale for choice of treatment modality in patients with laryngeal cancer
2. Compare outcomes among various treatment modalities for patients with laryngeal cancer

### Methods:

A retrospective review was conducted of patients treated for laryngeal cancer between 2006 and 2011. Data were recorded on treatment modality and rationale (radiation therapy (RT), transoral laser microsurgery (TLM), open partial laryngectomy (PL), or total laryngectomy (TL)), and oncologic/functional outcomes. Statistics included chi-square and bonferroni tests;  $p < 0.05$  denoted significance.

### Results:

79 patients were identified (18 RT, 19 TLM, 20 PL, and 22 TL). TLM was primarily used for early-stage disease, RT and PL for all disease stages, and TL for advanced disease. RT and TL were usually chosen due to tumor extension or patient health precluding conservation surgery. No surgical patients, but 28% of RT patients required permanent tracheostomy. Voice quality was similar for RT and TLM patients, while PL was significantly worse. All TLM patients resumed a normal diet; a small percentage of RT (17%), PL (10%), and TL (18%) patients required permanent feeding tube use.

### Conclusions:

Multiple treatment modalities for laryngeal cancer exist, and treatment decisions are usually driven by a combination of tumor characteristics, patient health, and patient preferences. Future research may better define the relative merits of the various treatment strategies available.

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## INTRODUCTION

Despite an overall decrease in the prevalence of tobacco abuse, laryngeal squamous cell carcinoma (SCC) is still diagnosed in roughly 11,000 patients each year in the United States<sup>1</sup>. Multiple treatment modalities exist for the management of this disease. Broadly speaking, these may be divided into four major categories: radiation therapy (RT) with or without chemotherapy, transoral laser microsurgery (TLM, commonly laser-assisted), open partial laryngectomy (PL, including supracricoid partial laryngectomy or supraglottic partial laryngectomy), and total laryngectomy (TL). Over the past decades significant changes have occurred in the management of laryngeal cancer; in particular, the advent of conservation surgical techniques has led to more early stage tumors being treated with surgery, while advanced stage tumors are increasingly treated with chemoradiation<sup>2</sup>.

Although some changes are driven by data, in many cases there is little data to accurately guide treatment choice<sup>3</sup>. A critical factor is often the treating physician's skill with these modalities; in many situations one or more modalities may simply not be available due to lack of proper equipment or expertise. However, even at tertiary centers where all modalities for management of laryngeal SCC are available, it is not clear exactly what factors are most important to actual treatment decisions. Thus, we undertook this study to examine the rationale for and outcomes of the various treatment modalities used for patients with laryngeal SCC

## METHODS AND MATERIALS

Clinic and operative records of the senior author (JSS) were queried for patients who presented with a primary diagnosis of squamous cell carcinoma of the larynx and who underwent subsequent treatment between January 2006 and October 2011. Both patients with a new diagnosis of laryngeal cancer as well as patient that had failed previous treatment outside our institution were included in analysis. Overall, 79 consecutive patients matching these criteria were identified. A retrospective chart review was conducted, and data were collected regarding patient demographics, tumor stage and pathology, prior treatments, rationale for chosen treatment modality, complications, tracheostomy use, feeding tube use, diet, and GRBAS (grade, roughness, breathiness, asthenia, and strain) score. Data were then entered into an electronic database for analysis. This review was approved by the Oregon Health and Science University institutional review board.

Descriptive statistics were performed on all data when possible. Patients were grouped based on treatment modality and these groups were compared using Bonferroni tests for continuous variables and chi-square tests for categorical data.  $P < 0.05$  was considered statistically significant.

## RESULTS

A total of 79 consecutive patients with laryngeal cancer were included in this study (Table 1). TLM was used in patients with low T stage tumors, while TL was reserved for advanced T stage tumors. PL and RT were used in a range of T stages, with the exception that RT was not used as a primary treatment modality in T4 tumors. The rationale for either RT or total TL was examined (Table 2); most patients had either tumor characteristics precluding conservation laryngeal surgery or poor functional status.

Treatment failures and additional therapy were also studied (Table 3). RT was generally salvaged using a variety of surgical techniques, while PL was only salvaged via total laryngectomy. TLM had a low failure rate and was easily salvaged by radiation therapy. Conversely, TL failures required extensive surgery, chemoradiation, or palliation.

Finally, voice and swallowing outcomes were analyzed across treatment groups (Tables 4 and 5). RT and TLM had similar voice outcomes, while PL was significantly worse. No patient receiving surgical therapy required permanent tracheostomy, while a significant number of RT patients were left with a permanent need for tracheostomy. TLM patients also had the best swallowing outcomes.

Table 1: Patient Demographics

	RT	TLM	PL	TL	Total	P value
N (%)	18 (23)	19 (24)	20 (25)	22 (28)	79 (100)	
Male (%)	14 (78)	14 (74)	16 (80)	19 (86)	63 (80)	0.64
Age±std dev	67.7±10.0	67.0±11.5	59.6±9.9	64.2±11.5	64.5±11.1	0.059
T1a	4	13	4	1	22	
T1b	4	1	1	0	6	
T2	7	0	6	10	23	
T3	3	5	5	3	16	
T4	0	0	4	8	12	
Previous RT (%)	0 (0)	3 (16)	10 (50)	13 (59)	26 (32)	0.001
Follow up (days)±std dev	870±599	632±441	602±518	413±264	611±479	0.55

## RESULTS

Table 2: Rationales for treatment plan

RT rationale	Number of patients (%)	TL rationale	Number of patients (%)
Anatomic considerations preventing conservation surgery	10 (56)	Cricoid involvement	13 (59)
Poor performance status	3 (17)	Poor lung function	3 (14)
Patient choice	4 (22)	Prior surgery with positive margins	3 (14)
Extranodal disease spread	1 (6)	Laryngeal stenosis	2 (9)
		Patient choice	1 (5)

Table 3: Treatment failures

Modality	# of patients	# of treatment failures	Further treatments (n)
Chemoradiation	18	3 primary	Total Laryngectomy (2)
			Endoscopic resection (1)
Transoral Laser Microsurgery	19	1 distant	Chemotherapy (1)
			Radiation (1)
Open Partial Laryngectomy	20	4 primary	Total laryngectomy (4)
			Palliation (1)
Total Laryngectomy	22	7 primary	Chemoradiation (3)
			Pharyngectomy+chemotherapy (1)
			Esophagectomy (1)
		1 distant	Palliation (2)
			Palliation (1)

Table 4: Voice outcomes

	RT	TLM			PL	P value
		T1+T2	T3+T4	total		
N	18	14	5	19	20	
# requiring tracheostomy (%)	5 (28)	0 (0)	1 (20)	1 (5)	20 (100)	0.01
Days to decannulation ± std dev	N/A	N/A	21	21	27±15	N/A
# with permanent tracheostomy (%)	5 (28)	0 (0)	0 (0)	0 (0)	0 (0)	0.02
Mean GRBAS score ± std dev	1.48±0.69	1.60±0.64	1.08±0.36	1.46±0.62	2.28±0.36	<0.001

Table 5: Swallowing outcomes

	RT	TLM			PL	TL	P value
		T1+T2	T3+T4	total			
N	18	14	5	19	20	22	
Feeding tube required (%)	5 (28)	0 (0)	3 (60)	3 (16)	20 (100)	22 (100)	0.04
Permanent Feeding tube required (%)	3 (17)	0	0	0	2 (10)	4 (18)	0.63
# without dietary restrictions (%)	14 (78)	14 (100)	5 (100)	19 (100)	17 (85)	16 (73)	0.21

## DISCUSSION

Inspection of our data reveals patterns in the ways patients were directed towards different treatments. In this series TLM was the clear favorite for T1a lesions, while radiation was used for the majority of T1b lesions, consistent with current data and practice patterns<sup>4-6</sup>. T4 tumors generally required a large resection as primary treatment, either PL or TL, consistent with current National Comprehensive Cancer Network guidelines<sup>7</sup>. Moderately sized tumors (T2 and T3) were treated with a variety of modalities. Overall, it is interesting to note that each modality was used with nearly equal frequency.

For the majority of TL and RT patients, treatment was chosen due to anatomic aspects of the tumor, previous treatment failure, or patient physiology that precluded conservation surgery. However, a number of patients preferred RT over conservation surgery, highlighting the importance of patient preference in determining a treatment plan. Another consideration in treatment choice is the salvage options available for each particular treatment modality. In general, we found that recurrence required an escalation of therapy: TLM failures required RT, RT failures required PL or TL, PL failures required TL, and TL failures required extensive resection or palliation.

Swallowing outcomes were generally good in all treatment modalities. TLM overall had the best results, with no long-term feeding tube use. PL, TL, and RT all had similar swallowing outcomes, with a small percentage of patients requiring long term feeding tubes. Perceptual voice outcomes were similar between TLM and RT, while PL resulted in significantly worse voice. This is in line with previous data on functional outcomes of these modalities<sup>8-10</sup>. We found that a subset of radiation therapy patients required long-term tracheostomy use, while no TLM or PL patients required a permanent tracheostomy. This highlights the idea that although RT represents "organ preservation" from the anatomic standpoint, this does not equate to preservation of laryngeal function<sup>11</sup>.

It is important to recognize that this study has several weaknesses. As a retrospective review, data collection was not standardized and outcome measurements was performed variable timepoints. This study lacks quality of life measures and objective measures of voice and swallowing function to more accurately compare functional outcomes. Also, this study population does not represent patients at the initial diagnosis of laryngeal cancer, but rather after referral to our institution, sometimes after failure of prior treatment. Thus, these results cannot necessarily be generalized to a general otolaryngology setting or to a population of patients with a newly diagnosed laryngeal cancer.

## CONCLUSIONS

These data provide insight into how and why patients with laryngeal cancer are allocated to available treatment modalities, what options are typically employed for salvage after these various modalities, and the functional outcomes of these procedures in a typical head and neck clinic. While these data support many of the previously published literature regarding treatment of laryngeal cancer, further research is needed to detail relative merits of these various treatment modalities in order to guide management decisions.

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