

## Supracricoid partial laryngectomy: an alternative to total laryngectomy for locally advanced laryngeal cancers

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### Abstract

**Objectives:** The management of advanced laryngeal cancer has evolved in the last century, from total laryngectomy to chemoradiation. The aim of this study was to examine our experience with supracricoid partial laryngectomy as a possible solution for patients with advanced laryngeal tumours, with a focus on the oncological safety of the procedure and the functionality of the preserved larynges.

**Study design:** We reviewed the medical records of patients with laryngeal cancer who had undergone primary or salvage supracricoid partial laryngectomy at our department between 1998 and 2004.

**Results:** Twenty-three patients treated with supracricoid partial laryngectomy for endolaryngeal squamous cell carcinoma were identified. Median follow-up time was 35 months. Twelve patients had advanced laryngeal tumours. Eight patients were radiation failures. These factors were not associated with increased local recurrence or with decreased survival.

**Conclusion:** Supracricoid partial laryngectomy appears to be a feasible option for the treatment of laryngeal tumours, even in the advanced stage or after failure of radiation therapy.

**Key words:** Larynx Neoplasms; Laryngectomy; Radiotherapy; Supraglottis

### Introduction

Total laryngectomy, first described over 100 years ago, was the treatment of choice for locally advanced laryngeal tumours until the 1990s, when reports of their dramatic response to chemoradiotherapy raised hopes that preservation of the larynges may be possible even in patients with advanced disease.<sup>1</sup> These findings were supported by the RTOG 91-11 (refers to the study conducted by the Radiation Therapy Oncology Group given the no 91-11 and published in the NEJM) study,<sup>2</sup> which reported an 88 per cent rate of larynges preservation following chemoradiotherapy. However, this treatment itself carries considerable morbidity and some mortality.<sup>2</sup> In addition, there are no proven data on the functionality of the preserved larynges after irradiation and on the dependence of treated patients on tracheostomy.

The literature contains several sporadic reports on the use of partial laryngectomy in selected cases of advanced laryngeal cancer. More recently, the more radical supracricoid partial laryngectomy procedure, wherein a whole circumferential portion of the larynx above the cricoid is removed, has been suggested as a potential alternative to total laryngectomy.<sup>3–6</sup>

The aim of the present study was to describe our experience with supracricoid partial laryngectomy

in a selected group of patients with advanced laryngeal tumours. Special emphasis was given to oncological safety and the functionality of the preserved larynges.

### Materials and methods

The computerised database of the otolaryngology and head and neck surgery department of the Rabin Medical Center was searched to identify all patients who had undergone primary or salvage supracricoid partial laryngectomy from 1998 to 2004. The criterion for supracricoid partial laryngectomy at our department was advanced anterior endolaryngeal squamous cell carcinoma that did not involve the arytenoids. The tumours were staged pre-operatively according to the American Joint Committee on Cancer system. Post-operative follow up was performed on a monthly basis in the first year, every two months in the second year and every three months thereafter.

For the present analysis, the patient files were reviewed for the following data: background characteristics, type of surgery, other pre- and post-operative treatment modalities, tumour characteristics, operative time, time to decannulation and nasogastric tube removal, operative outcome,

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histopathology results, presence of disease in the resection margins, post-operative course and complications, duration of follow up, local and nodal recurrences, and end-follow-up status.

## Results

### Patients

Twenty-three patients, 18 males and five females, met the inclusion criteria. Ages ranged from 17 to 85 years (mean, 60). Three patients were more than 75 years old at the time of surgery. The median duration of follow up was 35 months (range, 6–63).

### Tumour stage and location

Data on patients' tumour (T) staging and location are given in Table I. Pre-operatively, nine patients had T<sub>3</sub>–T<sub>4</sub> laryngeal carcinoma, including three in whom the tumour extended more than 10 mm to the subglottis. The remaining 14 patients had T<sub>1</sub>–T<sub>2</sub> laryngeal carcinoma, of whom five had failed radiation treatment and nine had large, anterior, horseshoe-shaped transglottic tumours reaching but not extending to the arytenoids. On

the basis of intra-operative findings of extra-thyroid extension, the T stage of two of the T<sub>1</sub>–T<sub>2</sub> tumours was changed to T<sub>4</sub>. In another patient, significant subglottic extension (>10 mm anteriorly) was found at surgery.

### Procedure

In eight patients, supracricoid partial laryngectomy was performed as salvage treatment after failure of radiation therapy. Supracricoid partial laryngectomy was performed in 10 patients, and supracricoid partial laryngectomy with resection of one arytenoid in nine patients. The four patients found intra-operatively to have major subglottic extension (>10 mm) underwent supracricoid partial laryngectomy with partial resection of the cricoid. Reconstruction consisted of cricothyroidoepiglottopexy in 17 patients, cricothyroidopexy in four patients and tracheocricothyroidoepiglottopexy in two patients after partial cricoid resection.

Post-operative radiation therapy was performed in 10 patients with positive margins or regional disease.

Two patients had pre-operative nodal disease (N<sub>1</sub>) and underwent neck dissection.

TABLE I  
CHARACTERISTICS OF ADVANCED LARYNGEAL TUMOURS

Pt no	Pre-op T stage	Location	Fixed vocal fold?	Remarks	Additional intra/post-op info
1	3	Transglottic	+		
2	1	LVF + RVF + ant commissure	-	Basaloid SCC	
3	3	RVF	+		
4	2	LVF + ant commissure + subglottic (min)	-		
5	2	RVF + LVF + epiglottic base; hypomobile LVF			
6	2	Transglottic + ant commissure			
7	3	LVF + ant commissure + 5 mm subglottic		Pre-epiglottic involvement (by CT)	
8	1	RVF + ant commissure			
9	2	Ant commissure + min subglottic extension			
10	3	Supraglottic	+	Pre-epiglottic space	
11	4	Ant transglottic + thyroid cartilage invasion		Radiation failure	Thyroid cartilage invasion + ant cricoid invasion
12	1	Ant commissure		Radiation failure	
13	2	Transglottic + ant commissure			Subglottic >10 mm
14	1	RVF basaloid		Radiation failure	
15	1	RVF		Radiation failure	LVF + ant commissure + false VF
16	2	RVF + subglottic (min)		Radiation failure	
17	3	Glottic (horseshoe)	+		Subglottic extension + ant cricoid invasion
18	2	Horseshoe + subglottic (2 mm)			Thyroid cartilage invasion
19	2	Transglottic			Thyroid cartilage invasion
20	2	RVF + LVF		Radiation failure	
21	3	RVF	+	Radiation failure	Subglottic >8 mm
22	3	RVF			Subglottic >10 mm
23	3	L transglottic	+	Radiation failure	Superior cricoid invasion

Pt no = patient number; pre-op = pre-operative; T = tumour; post-op = post-operative; info = information; L = left; R = right; VF = vocal fold; ant = anterior; SCC = squamous cell carcinoma; min = minimal; CT = computed tomography

*Locoregional failure*

Two patients had local recurrence, which was treated by salvage total laryngectomy. Both had undergone radiation treatment after supracricoid partial laryngectomy because of involved margins. In one of these patients, aggressive nodal disease later developed and was the cause of death. The other patient, with basaloid squamous cell carcinoma, was alive at the time of writing, with no suspected stomal recurrence.

Three patients had regional recurrence following supracricoid partial laryngectomy and radiation therapy, and all were treated with neck dissection. One of these patients had local recurrence as well and died of aggressive local disease. The other, with locoregional control, died of lung metastases. The third patient was alive with no evidence of disease at the time of writing.

*Survival*

Survival data are shown in Table II. Nineteen patients were alive at the time of the study, with no evidence of disease. Two patients had died of the disease, one with aggressive local recurrence and the other with distant metastasis. A third patient had died of other causes, and a fourth had been lost to follow up. The overall survival rate was 83 per cent and the disease-specific survival rate was 90 per cent.

*Functional outcome*

In 21 patients, the tracheal cannula was removed after a mean time of 24 days (median, 20; range, 10–76); one patient required laser evaporation of

an oedematous arytenoid before decannulation could be performed. The other two patients remained tracheostomised because of arytenoid oedema and a small glottic aperture. Both underwent post-operative radiation treatment.

The nasogastric feeding tube was left in place for a mean period of 16 days (range, 10–28), except in two patients who were dependent on gastrostomy for nearly three months because of intractable aspiration. Both these patients were radiation failures who were salvaged by supracricoid resections, and both had resection of one arytenoid.

All patients retained intelligible speech which improved with time. No objective assessment of voice quality was performed.

*Complications*

Five patients had post-operative chondronecrosis with laryngocutaneous fistulas: four were radiation failures and the fifth had diabetes mellitus. In two cases, the fistula closed spontaneously; in three cases, hyperbaric chamber treatment was required, which yielded good results.

**Discussion**

Satisfactory results for advanced laryngeal carcinoma with partial laryngectomy (T<sub>3</sub> and T<sub>4</sub>) were reported in the 1990s by Herranz-Gonzalez *et al.*<sup>6</sup> in 17 patients and by Adamopoulos *et al.*<sup>7</sup> in 13 patients. This prompted expectations of an even better outcome for supracricoid partial laryngectomy, which is a more radical procedure. Laccourreye *et al.*<sup>4</sup> noted good oncological results for supracricoid partial laryngectomy in patients with advanced laryngeal tumours

TABLE II  
OUTCOME OF SUPRACRICOID PARTIAL LARYNGECTOMY

Pt no	Surgical margins	Radiation		FU (mth)	Recurrence		Total laryngectomy	Neck dissection	End-FU status
		Pre-op	Post-op		Local	Nodal			
1	+	-	+	29	-	-	-	-	NED
2	-	-	+	43	-	+	-	+	DOD
3	-	-	-	33	-	-	-	-	Dead (other causes)
4	-	-	-	55	-	-	-	-	NED
5	+	-	+	38	+	+	+	+	DOD
6	+	-	+	25	-	-	-	-	NED
7	-	-	-	18	-	-	-	-	NED
8	-	-	-	9	-	-	-	-	NED
9	-	-	-	9	-	-	-	-	NED
10	-	+	-	51	-	-	-	-	NED
11	-	-	-	-	-	-	-	-	Lost to FU
12	-	+	-	63	-	-	-	-	NED
13	-	-	+	60	-	-	-	-	NED
14	+	+	-	29	+	-	+	-	NED
15	-	+	-	55	-	-	-	-	NED
16	-	+	-	36	-	-	-	-	NED
17	+	-	+	36	-	-	-	-	NED
18	+	-	+	13	-	-	-	-	NED
19	+	-	+	16	-	-	-	-	NED
20	-	+	-	58	-	-	-	-	NED
21	-	+	+	41	-	+	-	+	NED
22	+	-	+	7	-	-	-	-	NED
23	-	+	-	6	-	-	-	-	NED

Pt no = patient number; pre-op = pre-operative; post-op = post-operative; FU = follow up; mth = months; NED = no evidence of disease; DOD = dead of disease

who were preselected on the basis of their good response to chemotherapy. More recently, Dufour and colleagues<sup>5</sup> reported an overall laryngeal preservation rate of 89.8 per cent and a local control rate of 98.3 per cent in patients with T<sub>3</sub> endolaryngeal carcinoma treated by supracricoid partial laryngectomy. Thus, an extension of the indications for supracricoid partial laryngectomy may be anticipated.

The present study, although small and limited in follow up, supports these earlier results. Of our 23 patients, only two died of the disease, and two required salvage total laryngectomy for local recurrence. All the patients with T<sub>4</sub> lesions, and all the patients with significant subglottic extension, were alive with no evidence of disease at the time of writing. These findings indicate that an advanced T stage is not associated with an increased risk of failure or poor survival. As these numbers are no worse than those documented for total laryngectomy or chemoradiation, we suggest that supracricoid partial laryngectomy is oncologically safe and may serve as an alternative to total laryngectomy for locally advanced laryngeal cancer in selected cases.

Eight of the patients included in this study failed radiation treatment. Traditionally, radiation failure is followed by total laryngectomy. However, difficulty in assessing tumour extension has led clinicians to wonder whether total laryngectomy is always necessary, and to seek more conservative alternatives.<sup>8–10</sup> Biller *et al.*<sup>8</sup> suggested that partial laryngectomy might be used after radiation failure in patients with glottic-level disease who had been potential candidates for vertical laryngectomy prior to radiation, and in whom the tumour had not enlarged. Nichols *et al.*<sup>9</sup> showed that partial laryngectomy can be safely performed after radiation without significantly increasing the risk of chondronecrosis in the remaining laryngeal framework. Accordingly, Burns and colleagues<sup>10</sup> reported that although it is difficult to establish accurate, safe resection margins in the post-radiation larynx, it is not unsafe to perform partial laryngectomy in selected cases.

Spriano *et al.*<sup>11</sup> examined the feasibility of supracricoid partial laryngectomy as a salvage procedure in 15 patients who failed radiation treatment. Twelve had no tumour recurrence after 36 months of follow up, with satisfactory functional results. Similarly, Laccourreye *et al.*<sup>12</sup> reported an 83 per cent actuarial survival rate in 12 patients managed with supracricoid partial laryngectomy after radiation failure. However, in both studies, local morbidity was higher than in nonirradiated patients, and included arytenoid oedema, chondritis and neck abscess.

In the present study, all eight patients who failed radiation treatment were alive at the end of follow up. One had local recurrence and was treated by salvage total laryngectomy, and another had regional recurrence and was treated by salvage neck dissection. Although half these patients had post-operative chondronecrosis, all responded to conservative treatment (hyperbaric chamber treatment in three). We suggest that although supracricoid partial laryngectomy affords an overall good oncological solution

to advanced laryngeal cancer, the risk of chondronecrosis should not be underestimated.

Four of the patients included in our study had subglottic extension of the tumour. Subglottic tumours, or glottic tumours with subglottic extension of more than 10 mm, are traditionally considered untreatable by partial surgery. Moreover, involvement of the cricoid cartilage was considered until recently to be the most significant limitation for supracricoid resection.<sup>3</sup> Despite the recent tendency to opt for chemoradiation instead of total laryngectomy for these advanced laryngeal tumours, several authors reported good oncological results for supracricoid partial laryngectomy with tracheocricohyoidoepiglottopexy<sup>13</sup> or with partial resection of the cricoid cartilage.<sup>14</sup> Sparano *et al.*<sup>15</sup> suggested that organ-preservation surgery is possible in some subglottically extended carcinomas, when the extension is less than 15 mm and does not involve arytenoid fixation. Our patients with subglottic extension also did well with supracricoid partial laryngectomy and partial cricoid resection and cricohyoidoepiglottopexy or tracheocricohyoidoepiglottopexy.

- **Chemoradiation has been found to be an effective alternative to total laryngectomy treatment of advanced laryngeal cancer, but it carries considerable morbidity, and data on functional outcome are incomplete**
- **Reports of good results for partial laryngectomy have led to expectations of an even better outcome for supracricoid partial laryngectomy, a more radical procedure which still spares the larynges**
- **This study reports a single-centre experience with supracricoid partial laryngectomy in 23 patients with advanced disease treated with supracricoid partial laryngectomy over a six-year period; results support the few small studies conducted to date, indicating that the procedure is an oncologically safe and effective option in selected cases, as both a primary procedure or a salvage procedure after radiation failure**

Supracricoid resection is a radical operation in which the vocal fold, thyroid cartilage, and pre-epiglottic and paraglottic spaces are removed. Even so, sparing even one cricoarytenoid unit may preserve voice and prevent aspiration. Because of its high neo-glottic position, the base of the tongue also protects against aspiration. Our patients all achieved oral feeding, although this took up to three months in two of them. In addition, all but two patients were tracheostomy free. There is currently no good objective measure of voice quality. There is a large variation in voice quality following supracricoid partial laryngectomy, from excellent to very breathy, partially depending on the number of

arytenoids preserved and the amount of mucosa left around the arytenoids.

Over the years, modifications of the initial surgical procedure have been made. Naudo *et al.*,<sup>16</sup> Laccourreye *et al.*<sup>13</sup> and, later, Shiotani *et al.*<sup>17</sup> have all suggested that when one cricoarytenoid unit is involved by tumour, supracricoid resection can be extended to include it, thereby broadening the indications for the procedure. Nine patients in our group underwent resection of one arytenoid as part of surgery, because of an intra-operative finding of tumour encroachment. During follow up, all nine were gastrostomy free, and all but one were tracheostomy free.

### Conclusion

The present study suggests that supracricoid resection may serve as an oncologically safe and effective alternative to both total laryngectomy and chemoradiation for advanced laryngeal tumours.

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