The Journal of Laryngology & Otology (2006), ***120***, *764–769*.

doi:10.1017/S0022215106002210
Printed in the United Kingdom
First published online 26 July 2006

Main Article

Early supraglottic cancer: how extensive must surgical resection be, if used alone?

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Abstract

Objectives: Two centre based evaluations of oncologic results of endoscopic resection of supraglottic cancer without post-operative irradiation.

Patients and methods: Twenty-six patients with clinical T_1 ($n = 5$) or T_2 ($n = 21$) primary squamous cell carcinomas of the supraglottic larynx and with N_0 ($n = 24$) or N_1 ($n = 2$) neck disease were treated by endoscopic supraglottic laryngectomy coupled with neck dissection(s). Endoscopic resection was standardized whereas neck dissections (NDs) varied from classical modified radical ND to selective ND of levels I to IV.

Results: Pathologically, three T_2 patients were upstaged to T_3, four N_0 patients to N_1 and one N_2 patient down-staged to N_1. Within an average of 42 months, there were no local failures and only one regional failure.

Conclusions: Endoscopic resection of T_1 and T_2 supraglottic cancer without post-operative irradiation achieved good oncological results. No patients with lateralized primary cancers were found to have contralateral cancer on pathological evaluation from bilateral dissections.

Key words: Larynx; Neoplasms; Laryngectomy; Endoscopic Surgical Procedures

Introduction

Endoscopic resection of supraglottic carcinomas was first described by Jackson and Jackson (quoted in Werner *et al*.) in 1939.[1] Forty years later, Vaughan (with colleagues and alone) first reported resection of supraglottic cancer with CO_2 laser.[2,3] In the beginning of the 1980s, Steiner expanded the indications for curative laser treatment to all regions and all tumour types of the larynx.[4] Since then, different groups have been able to show that transoral CO_2 laser resection of supraglottic tumour is a technique involving minimal patient stress and low morbidity.[5–9] In most cases, temporary tracheotomy can be avoided and nutrition via feeding tube needed for only a few days, in comparison with external approaches. Thus, quality of life after endoscopic partial resection is significantly superior to that following conventional techniques, especially in the first post-operative weeks. Against this background, is further research needed on endoscopic resection of supraglottic carcinoma?

The aim of the present investigation was neither to repeat sufficiently published results on functional outcome in hospital or at home, nor to describe the average times of feeding tube use or long-term function. Our objective was to establish internationally acknowledged treatment concepts applicable not only to surgical resection of the primary tumour but also the treatment of the whole tumour. The aim of our study, performed in two different institutions with established laser surgery programmes, was to define the necessary extent of an exclusively surgical approach to the primary tumour and the lymphatic drainage.

A proposal for classification of endoscopic cordectomy was published in 2000 by the working committee of the European Laryngological Society.[10] To date, no published classification exists for endoscopic supraglottic laryngectomy (a system was developed by Eckel and Remacle but not published) (HE Eckel, personal communication). The present study was intended to generate data on the location and resection of supraglottic carcinomas of the larynx, with the aim of aiding establishment of a classification of supraglottic laryngeal carcinomas.

Stage I and II supraglottic squamous cell carcinoma have been traditionally treated by either irradiation or surgery. Radiation alone has traditionally been used in stage I and II cancers, and occasionally in stage III cancers which are N_0 or N_1 (using the tumour–node–metastasis (TNM) classification system).[11–14] The alternative to this approach has

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Accepted for publication: 14 February 2006.

been open supraglottic laryngectomy coupled with neck dissection, almost always bilateral. For clinically staged N_0 necks, most surgeons currently perform selective neck dissection of at least lymph node levels II to IV. Patients who are N_+ in the neck more typically undergo modified radical neck dissection with spinal accessory nerve preservation on the clinically positive neck side and selective neck dissection on the opposite neck side.

One of the aims of this current investigation was to determine if endoscopic supraglottic laryngectomy alone would result in acceptable local control rates. Another significant aim of this investigation was to determine how many patients benefitted from bilateral neck dissection. As noted earlier, bilateral neck dissection has been advocated by almost all surgeons in patients with supraglottic cancer because the propensity to bilateral neck spread has been felt to be significantly high. Our intent was to retrospectively analyse how many N_0 patients, especially those with lateralized cancers, had cancer spread to the contralateral neck as determined by bilateral dissections.

Methods and materials

Twenty-six patients with T_1 or T_2 supraglottic squamous cell carcinoma were included. Thirteen patients were treated at the University of Utah in Salt Lake City, Utah, USA, and 13 at the Philipps University of Marburg, Marburg, Germany. Patients were staged according to the American Joint Committee on Cancer Guidelines, including the German patients. All patients were evaluated with computed tomography or magnetic resonance imaging before definitive surgery.

As the actual surgical technique of endoscopic supraglottic laryngectomy has been previously reported,[6,7,9,15,16] only a few salient comments will be made. Use of a bivalved laryngoscope (Weerda, #8588A, Karl Storz, Tuttlingen, Germany) greatly facilitated exposure. Endotracheal intubation was best performed with laser-protected tubes. Prophylactic clipping or cauterizing of vessels entering the supraglottis in the pharyngoepiglottic folds lessened the risk of post-operative bleeding, and resection of the suprahyoid epiglottis usually greatly improved visualization. Elevation of the internal perichondrium of the thyroid cartilage helped ensure tumour clearance in this area, and preservation of the arytenoid cartilage was critical in avoiding post-operative aspiration.

All 26 patients successfully underwent endoscopic supraglottic laryngectomy and were further treated by neck dissection, usually bilateral. Tables I and II show the extent of neck dissection at Philipps University of Marburg and the University of Utah, respectively. All US patients underwent selective neck dissection of lymph node levels II to V, whereas some German patients underwent variations of selective neck dissection or modified radical neck dissection. Whereas most patients underwent bilateral neck dissection, some more recently treated N_0 patients underwent only ipsilateral dissections.

No patient underwent tracheotomy in either group or had any post-operative airway compromise. No post-operative haemorrhage occurred in any of the patients. Feeding tubes were placed in two of the 13 US patients and 11 of the 13 German patients. The reason for this approach related to the philosophy of the senior surgeons.

Results

The follow-up interval ranged from 22 to 68 months, with an average time of 42 months. Three of the 13 US patients were pathologically upstaged from T_2 to T_3 cancers. Four of the 13 US patients and one of the 13 German patients had occult N_1 neck disease. One German patient was down-staged from a clinical N_2 to a pathological N_1 neck.

In the follow-up period, there were no local recurrences and only one neck recurrence, in the ipsilateral neck following selective neck dissection in one US patient. For the total group, total control was 100 per cent and neck control 96 per cent.

Seventeen of the 26 patients had lateralized cancers, and nine of the 26 patients had midline or near-midline lesions. In the 17 lateralized patients, no patient was found to have contralateral neck disease. Occult cancer was found in three lateralized cancer patients and in one midline cancer patient. Survival for the total group was 18 of 26 patients, or 69.2 per cent. None of these patients died from cancer recurrence.

Feeding tube placement ranged from four to 69 days. Both US patients affected had feeding tubes removed at 14 days. Eleven of the 13 German patients had feeding tubes removed before 30 days, with an average time of 18 days.

Discussion

In the last decade, endoscopic supraglottic laryngectomy has been introduced as an alternative to open supraglottic laryngectomy. Advocates of this approach to early supraglottic cancer have followed two separate therapeutic philosophies. German surgeons have popularized endoscopic supraglottic laryngectomy and neck dissection without post-operative irradiation.[6,7,15,16] In T_1 and T_2 supraglottic cancers (and selected T_3 cancers), neck dissections have been performed bilaterally, with post-operative irradiation reserved for pathological indications in the neck. Patients with positive surgical margins have usually been re-operated at the primary site to gain clear margins. Patients with N_2 neck disease or pathologically demonstrated extracapsular spread have also received post-operative irradiation. In almost all of these treatment schemes, the neck has been treated bilaterally, usually only by surgery.

The alternative treatment philosophy has involved endoscopic supraglottic laryngectomy coupled with post-operative irradiation.[9] In this approach, T_2 N_0 supraglottic cancer patients have undergone endoscopic supraglottic laryngectomy and post-operative irradiation to include the primary site and both neck sides. Post-operative irradiation to the primary

https://doi.org/10.1017/S0022215106002210 Published online by Cambridge University Press

TABLE I

RESULTS FROM PHILIPPS UNIVERSITY OF MARBURG, GERMANY

Patient	Sex	Clinical stage	Site	Neck surgery	Pathological stage	Follow up (months)	Status	Comments
1	M	T_2 N_0 M_0	R laryngeal epiglottis	SND II–IV (bilat)	No neck cancer	27	Dead	Unknown
2	M	T_1 N_0 M_0	R laryngeal epiglottis	SND II–IV (L) MRND (R)	N_0 upstaged to N_1 ipsilateral	27	Dead	Unknown
3	M	T_1 N_2 M_0	Larynx, epiglottis, vocal folds	SND I–IV (L) MRND (R)	No neck cancer	56	Alive	w/o cancer
4	M	T_2 N_0 M_0	R ventricular fold	SND II–IV (R)	No neck cancer	55	Alive	w/o cancer
5	M	T_2 N_0 M_0	Epiglottis	SND I–III (bilat)	No neck cancer	54	Dead	Renal failure
6	F	T_1 N_0 M_0	C laryngeal – lingual epiglottis	MRND (L)	No neck cancer	22	Dead	Cardiac failure
7	M	T_2 N_0 M_0	Larynx, epiglottis, vocal folds, sinus	SND I–IV (bilat)	No neck cancer	51	Alive	w/o cancer
8	M	T_2 N_0 M_0	R epiglottis	SND I–IV (bilat)	No neck cancer	39	Alive	w/o cancer
9	M	T_2 N_0 M_0	R aryepiglottic fold	SND II–V (L) SND I–V (R)	No neck cancer	37	Alive	w/o cancer
10	M	T_2 N_0 M_0	C laryngeal epiglottis	SND I–III (L) MRND (R)	No neck cancer	32	Alive	w/o cancer
11	M	T_2 N_0 M_0	C epiglottis	MRND (bilat)	No neck cancer	30	Alive	w/o cancer
12	M	T_1 N_1 M_0	C epiglottis	SND I–IV (bilat)	No neck cancer	30	Alive	w/o cancer
13	M	T_1 N_0 M_0	L ventricular fold	MRND (L) SND I–V (R)	N_1 ipsilateral	24	Alive	w/o cancer

M = male; T = tumour; N = node; M = metastasis; R = right; SND = selective neck dissection; bilat = bilateral; L = left; MRND = modified radical neck dissection; w/o = without; F = female; C = central

TABLE II

RESULTS FROM UNIVERSITY OF UTAH, USA

Patient	Sex	Clinical stage	Site	Neck surgery	Pathological stage	Follow up (months)	Status	Comments
1	F	T_2 N_0 M_0	L aryepiglottic fold	Bilat II–IV	No neck cancer	68	Alive	w/o cancer
2	M	T_2 N_0 M_0	L false vocal fold	Bilat II–IV	Ipsilateral N_1 (II) T_2–T_3 pre epiglottic	60	Alive	w/o cancer
3	M	T_2 N_0 M_0	R aryepiglottic fold	Bilat II–IV	Ipsilateral N_0 to N_1	61	Dead	w/o cancer
4	F	T_2 N_0 M_0	L aryepliglottic fold	Bilat II–IV	Ipsilateral N_0 to N_1	66	Dead	wo cancer
5	F	T_2 N_0 M_0	Infrahyoid epiglottis	Bilat II–IV	No neck cancer	60	Dead	w/o cancer
6	F	T_2 N_0 M_0	L aryepiglottic fold	Bilat II–IV	No neck cancer	64	Alive	wo cancer
7	F	T_2 N_0 M_0	Infrahyoid epiglottis	Unilat II–IV	N_0 to N_1 (II) T_2 to T_3 pre epiglottic	29	Alive	w/o cancer
8	F	T_2 N_0 M_0	L aryepiglottic fold	Unilat II–IV	No neck cancer	23	Dead	w/o cancer
9	M	T_2 N_0 M_0	L aryepiglottic fold	Unilat II–IV	No neck cancer	29	Alive N_2 disease in contralateral neck at 23 months. Contralateral MRND at 29 months	w/o cancer
10	M	T_2 N_0 M_0	R aryepiglottic fold	Unilat II–IV	T_2 to T_3 pre epiglottic	26	Alive	w/o cancer
11	F	T_2 N_0 M_0	R aryepiglottic fold	Unilat II–IV	No neck cancer	31	Alive	w/o cancer
12	F	T_2 N_0 M_0	Infrahyoid epiglottis	Bilat II–IV	No neck cancer	51	Alive	w/o cancer
13	M	T_2 N_0 M_0	L aryepiglottic fold	Unilat II–IV	No neck cancer	34	Alive	w/o cancer

F = female; T = tumour; N = node; M = metastasis; L = left; Bilat = bilateral; w/o = without; M = male; R = right; Unilat = unilateral; MRND = modified radical neck dissection

site has not been done to sterilize positive margins but rather has occurred almost incidentally due to the primary site not being shielded during bilateral neck irradiation. Patients who initially present with N_1 or greater neck disease are treated by endoscopic supraglottic laryngectomy with neck dissection on the side of the known cancer and then by post-operative irradiation to the primary site in both neck sides. In this situation, the contralateral N_0 neck side is treated by radiation only.

When the results of these different therapeutic approaches are carefully analysed, primary site control due to surgery only for stage I and II supraglottic cancers is in the 80–90 per cent range, both for the primary site and the neck.[6,7,9,14–16] Previous work done at the University of Utah resulted in 97 per cent primary site control in patients receiving endoscopic operations and irradiation.[9] Whereas this local control rate is 10–15 per cent higher than that in patients treated by endoscopic surgery alone, we must ask whether irradiation was added unnecessarily, rather than being reserved for later (and possibly more effective) use. A second potential problem with post-operative radiotherapy following supraglottic laryngectomy is the greater patient functional morbidity, evidenced by significantly longer use of post-operative feeding tubes and even long-term gastrostomy alimentation. The risks of aspiration and tracheotomy dependency are also increased in combination therapy patients.[17,18]

Endoscopic supraglottic laryngectomy in this small series resulted in a 100 per cent local control rate. Whereas procedures were performed in two separate medical centres, the endoscopic resection technique was the same. Findings from this limited experience are certainly consistent with those from previously published literature suggesting that endoscopic supraglottic laryngectomy is an effective tool, in the hands of experienced surgeons, for treating early supraglottic cancer.[6,7,9,15,16] We feel that open supraglottic laryngectomy in early-stage supraglottic cancer is not needed unless adequate exposure cannot be obtained endoscopically. We further believe that post-operative irradiation to the primary site is not indicated in these patients.

A question not addressed in this small series of early supraglottic cancer is whether the primary site should be irradiated in patients with more extensive neck disease who need radiation based on neck criteria. Currently, these patients typically receive primary site irradiation along with their neck irradiation. However, with current intensity modulated radiation therapy, the primary site irradiation could be spared in these patients as well.

Consistent with earlier literature, we did note that some apparently T_2 supraglottic cancers were really T_3, based on microscopic pre-epiglottic space invasion.[19] We actually found a smaller incidence of this than did previous series, but nonetheless feel strongly that the pre-epiglottic space must be fully resected to avoid local failure in this area; this may account for our higher local control rate. Conversely, we did not tailor our surgery to preserve the pre-epiglottic space, as has been suggested by at least one publication.[16] We feel that this is not a good idea and that endoscopic resection performed with full epiglottic space removal is, for all practical purposes, the same oncologic excision as is performed in open procedures. The difference, of course, is avoidance of division of normal tissues and their subsequent reconstruction by coming in and out of the larynx.

We initially performed bilateral neck dissections in all patients. We found occult metastatic disease in only four of the 26 patients, or 15.4 per cent. This is somewhat lower than the rate reported in the literature but, of course, has no statistical relevance as our series was so small. What is important, however, is that, in the 17 patients with lateralized cancer, no patient was found to have disease in the contralateral neck. Three of these patients with lateralized cancers did have occult ipsilateral disease but no contralateral spread. This finding is in agreement with the work of DeSanto *et al.*, who analysed a large series of supraglottic cancer patients undergoing either unilateral or simultaneous bilateral neck dissection.[20] Of particular interest in this study was the fact that, of patients shown to be pathologically free of cancer at unilateral neck dissection (90 patients), only one later developed neck cancer. Certainly, our 14 lateralized supraglottic cancer patients who had no ipsilateral or contralateral cancer spread were consistent in this respect. Our three patients with occult ipsilateral cancer in the lateralized cancer group had their contralateral neck side dissected and had no tumour. Of course, we do not know whether these patients would have developed cancer later had they not undergone bilateral dissection.

- **Endoscopic supraglottic laryngectomy in this small series had a 100 per cent local control rate. Primary site irradiation in early supraglottic cancer patients is not routinely needed**
- **Patients with lateral supraglottic cancers who are pathologically free of disease in the ipsilateral neck dissection specimen had no cancer spread in the contralateral neck**
- **Contralateral neck dissection or post-operative irradiation of the contralateral neck in patients with no disease on the ipsilateral side constitutes over-treatment**
- **Morbidity from endoscopic supraglottic laryngectomy with neck dissection was very limited in this series, with no patient needing tracheostomy and only one patient needing long-term enteral alimentation**

We feel that the results of DeSanto *et al.*, and those of our own small series raise a very significant question related to the management of the neck in supraglottic cancer. While bilateral neck treatment

https://doi.org/10.1017/S0022215106002210 Published online by Cambridge University Press

remains standard practice (either surgery or, in the case of N_0 necks, irradiation), we seriously question whether this is not over-treatment of a significantly large number of patients. The current approach is probably based on tradition, as few papers have analysed bilateral neck dissection in the manner of DeSanto *et al*. or the present study. What is needed is a critical review of patients undergoing bilateral neck dissection in N_0 disease with lateralized supraglottic cancer. How often is contralateral cancer found, if at all, in patients with no ipsilateral spread? Whereas prospective, randomized studies of head and neck disease are difficult to do, such research could in fact be done on a multi-institutional basis to more clearly answer the question. Bilateral neck irradiation and bilateral surgery in N_0 necks with lateralized cancer should not be performed without clear data supporting the need for this.[21] We question whether this data really exists. We feel that analysis of the ipsilateral neck in N_0 patients with lateralized cancer may allow many patients to avoid unnecessary contralateral dissection or irradiation.

At present, patients with more midline lesions still need neck dissection, as it is not clear to which neck side cancer spread might potentially occur. Those patients who are irradiated have excellent neck control, but without an understanding of whether cancer was present or not. Patients undergoing bilateral neck dissection will have their cancer staged, but in many instances will also undergo unnecessary dissection if there is no cancer spread.

The sentinel node concept may give important guidance in this area.[22] We have used this concept in patients with midline supraglottic cancer (results reported separately). In this series, when tracer uptake was analysed in the three lymph nodes of highest uptake in each patient, bilateral sentinel nodes were seen in six of 11 patients and unilateral sentinel nodes in five of 11.[23] In two of six bilateral patients, a radiolabelled sentinel node with an isolated metastasis was found in one neck site, whereas four of six patients were tumour free in the sentinel nodes. Three of five unilateral patients had radiolabelled sentinel node uptake, whereas two of five patients had no cancer detected. Interestingly, metastatic nodes were detected in five of 11 patients (45 per cent) in this series. No cancer was found in any non-labelled node on neck dissection.

This limited but two-institutional study suggests that the sentinel lymph node concept may have application in determining whether patients with midline lesions need bilateral dissection. The results also emphasize that very careful and critical analysis of lymph nodes is needed to ensure that micrometastases are not missed. This obviously needs further confirmation in a much larger series.

Based on the need for internationally acknowledged treatment concepts (as mentioned in the introduction), the present results allow the following conclusions to be drawn.

Conclusions

In this small series, endoscopic supraglottic laryngectomy had a 100 per cent local control rate. We feel that primary site irradiation in these early supraglottic cancer patients is not routinely needed.

Patients with lateralized supraglottic cancers who are pathologically free of disease in the ipsilateral neck dissection specimen had no cancer spread in the contralateral neck. We feel contralateral neck dissection or post-operative irradiation of the contralateral neck in patients with no disease on the ipsilateral side probably constitutes over-treatment. This should be evaluated in a prospective, randomized study.

Morbidity from endoscopic supraglottic laryngectomy with neck dissection was very limited in this series, with no patient needing tracheotomy and only one patient needing long-term enteral alimentation.

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Dr J A Werner takes responsibility for the integrity of the content of the paper.
Competing interests: None declared