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MAIN ARTICLE

Audit of transoral laser-assisted microsurgical resection of early laryngeal cancer

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Abstract

Objective: This study aimed to report our current practice of transoral laser microsurgery for early glottic cancer against the standards outlined by the ENT UK Head and Neck Group and assess the oncological outcome.

Method: A retrospective review of case notes of patients diagnosed with early glottic cancer (tumour stages T_{is}, T_1 and T_2) who underwent transoral laser microsurgery as a primary curative treatment. The minimum follow-up period was two years.

Results: Thirty-one patients had transoral laser microsurgery for early glottic cancer during the study period. Eighty-four per cent of cases were discussed by a multidisciplinary team prior to transoral laser microsurgery. Complete circumferential excision was achieved in 77 per cent of cases. Sixty-five per cent of specimens were subjected to histological analysis; they complied with standard pathology reporting for margins. Within 12 months of transoral laser microsurgery, there were 10 residual cases and 2 recurrences. Kaplan–Meier survival analysis gave disease-free survival rates of 96.8 per cent at 18 months and 93.5 per cent at 24 months. The laryngectomy-free survival rate was 96.8 per cent at two years.

Conclusion: The findings of this audit are encouraging and have highlighted areas for further discussions, recommendations, training and education.

Key words: Laryngeal Neoplasms; Laser Therapy

Introduction

Over the years, laryngeal cancer treatments have developed with the aim of providing oncological control and preserving a functioning larynx.[1] Transoral laser microsurgery is increasingly being offered as an alternative option to external beam radiotherapy for managing early laryngeal cancer. It has reduced morbidity and a shorter treatment time compared with external beam radiotherapy.[2]

In our department, selection of either transoral laser microsurgery or external beam radiotherapy as the preferred treatment modality is based on factors such as patient preference, clinical evaluation, likely functional outcome (especially for the voice) and the availability of expertise in transoral laser microsurgery. In 2009, the ENT UK Head and Neck Group released a consensus statement on transoral laser microsurgery for early glottic cancer which provides guidance on the standards for patient selection, surgical care and follow up.[3]

The Head and Neck Unit at NHS Lothian, Edinburgh, UK, has offered transoral laser microsurgery for early laryngeal cancer since 2002. This study aimed to analyse our practice of transoral laser microsurgery compared with standards outlined by the consensus statement of the ENT UK Head and Neck Group and to present the oncological outcomes for local and distant tumour control.

Materials and methods

A retrospective case note review was performed for all patients who underwent transoral laser microsurgery for early laryngeal cancer between April 2009 and August 2011. The term 'early laryngeal cancer' refers to the stage T_{is}, T_{1a}, T_{1b} and T_2 carcinomas of the larynx without positive cervical lymph node metastasis. Resection was performed using a CO2 laser (Sharplan, Tel Aviv, Israel) with a power setting of 2–8 W, used in superpulse mode on a continuous setting with a variable spot size. The laser was coupled to an Acuspot micromanipulator (Sharplan). The extent of transoral laser microsurgery resection was documented and classified based on the European Laryngeal Society endoscopic cordectomy classification.[4] Data on patient demographics, surgical records, histopathology reports and clinical progress were collected from case notes.

Standards for audit

Audit standards were adapted from the ENT UK consensus statement on standard of care.[3] The standard

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of care for all patients with squamous cell carcinoma of the glottis stage T_{1a}, T_{1b} or T_{2a} is that they are offered transoral laser microsurgery as part of the informed choice treatment options. The option of transoral laser microsurgery should be discussed by the multidisciplinary team (MDT) for all patients with glottic squamous cell carcinoma stages $T_{1a–b}$ or T_2, with documentation of the reasons for the particular treatment being selected. Patients should be clearly informed of the range of feasible treatment choices; clinicians should ensure that an informed choice is made, using standardised information to avoid the risk of bias.

The consensus agreement on surgical care states that the aim of endoscopic excision should be complete circumferential excision of all small lesions under magnification; the use of translesional excision should only be used to improve surgical access or when it is not possible to safely excise the lesion completely as one specimen. All specimens must be orientated and mounted for histological analysis. An excellent reporting relationship between the surgeon and pathologist should be ensured. It is advisable for the pathologist to specify sites precisely on the orientated specimen where the margins are less than 1 mm. This helps in planning 'second-look' or revision surgery and during follow up.

Based on the pathologist's report, several actions are recommended. If the resection margins are considered surgically adequate and are clear by 1 mm or more upon histology analysis, then a second-look procedure is not warranted. In such cases, routine clinical monitoring is recommended. If the surgical margins are not in doubt but histological analysis shows tumour at the resection margins, then a second look is recommended 6–8 weeks later. If the surgeon has concerns about resection margins and residual tumour is confirmed upon histological analysis, then the feasibility of further transoral laser microsurgery resection should be considered. Oncological outcomes were analysed in terms of disease-free survival, overall survival and laryngectomy-free survival at 18 months and 2 years using Kaplan–Meier analysis.

Results

Within the study period, a total of 31 patients were treated with transoral laser microsurgery for early laryngeal cancer at our unit. The mean patient age was 68 years (range 42–82 years). In 11 patients, tumours were staged as T_{is}, in 17 patients as T_{1a}, in 2 as T_{1b} and in 1 as T_2. The mean follow-up time was 41 months (range 28–56 months). Tumours were located in the glottis in 28 patients and in the supraglottis in 3. No transoral laser microsurgery for subglottis tumours was performed during the study period.

An MDT discussion took place in 84 per cent of cases, and treatment options including primary radiotherapy were discussed with these patients. Two patients (6 per cent) were not local to Lothian Health Board but underwent transoral laser microsurgery at our unit; therefore, no documentation of an MDT discussion was available. Three patients (10 per cent) had initial transoral laser microsurgery for laryngeal dysplasia or leukoplakia, but subsequent histological assessment indicated an early stage cancer. In these cases, prior MDT discussion did not take place.

Complete excision was achieved in 77 per cent of cases. Four patients underwent translesional excision and one patient was described as undergoing piecemeal excision. For two patients, there was no documentation of the type or form of excision. Forty-two per cent of patients underwent type 2 cordectomy, 23 per cent underwent type 1, 20 per cent underwent type 3 and 10 per cent underwent type 5a. The cordectomy extent was not clearly documented for two patients (Table I). All procedures including initial transoral laser microsurgery, second-look surgery and subsequent endoscopic examinations were photographed and recorded; however, 76 per cent were documented as not accessible during follow-up review. Sixty-five per cent of resection specimens were mounted and orientated on cucumber or sponge. There was no documentation of specimen orientation in 11 cases. Histopathological reporting complied with the standards outlined. However, thermal damage was noted in 9.5 per cent of samples, leading to difficulty in identifying deep margin clearance.

Based on the histopathology analysis of resected specimens, 23 patients had second-look surgery, of which 7 underwent further transoral laser microsurgery resection. Three patients underwent salvage radiotherapy. Eight patients had routine clinical monitoring following complete resection by initial transoral laser microsurgery. Patients were reviewed every four to six weeks in the first year, every two to three months

TABLE I
SURGICAL DETAILS AND OUTCOMES ACCORDING TO TUMOUR STAGE

Surgical details and outcomes	T_{is}	T_{1a}	T_{1b}	T_2	Total
Number	11	17	2	1	31
Excision type					
– Circumferential	8	14	2	1	25
– Translesional	2	2	0	0	4
– Not documented	1	1	0	0	2
Cordectomy types*					
– Type I	6	1	0	0	7
– Type II	3	10	0	0	13
– Type III	1	4	0	1	6
– Type IV	0	0	1	0	1
– Type V	0	2	1	0	3
– Not documented	1	0	0	0	1
Residual†					
– Further TLM	4	3			
– ERBT	1	2			
Recurrence‡	1		1		

*Cordectomy types based on European Laryngeal Society endoscopic cordectomy[4]. †Within 12 months of initial TLM. ‡After 12 months of initial TLM. TLM = transoral laser microsurgery; ERBT = external beam radiotherapy

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in the second year, four monthly in the third year, and six monthly in the fourth and fifth years.

In the first 12 months following the initial transoral laser microsurgery, 10 patients were found to have residual disease (those with positive margins at the initial transoral laser microsurgery were included in this group). Seven underwent further transoral laser microsurgery resection: one of these underwent three transoral laser microsurgery procedures and another underwent four transoral laser microsurgery procedures within a year of follow up. The remaining 3 out of the 10 patients with residual disease underwent salvage radiotherapy. None of these patients developed a recurrence. There were two cases of recurrence in our patient cohort. In one patient, a $T_{1a}N_0M_0$ tumour recurred 19 months after transoral laser microsurgery for a T_{1a} tumour. This patient underwent further transoral laser microsurgery resection. In the other patient, the recurrent tumour was classified as $T_4N_1M_0$ 13 months after transoral laser microsurgery for a T_{1b} tumour (Table II).This patient underwent total laryngectomy and bilateral neck dissection. The mean time to recurrence was 16 months. At the last notes review performed in August 2013, no mortality or further recurrence in the study group was recorded.

Kaplan–Meier survival analysis with censoring for disease-free survival including salvage radiotherapy (Figure 1), gave a rate of 96.8 per cent at 18 months and 93.5 per cent at 24 months. The laryngectomy-free survival rate was 96.8 per cent at two years (Figure 2).

Discussion

The efficacy of transoral laser microsurgery for local tumour control and functional outcome in early glottic cancer management was reported to be comparable with external beam radiotherapy in several retrospective analyses.[5–7] To date, no prospective randomised trials comparing radiotherapy and laser surgery for early glottic cancer have been published, and the decision about treatment modality in most centres is mainly based on clinician's preference, local policy and patient's preference. The Early Stage Glottic Cancer: Endoscopic Excision or Radiotherapy ('EaStER') feasibility study trial was initiated but had to be closed in 2008 because of poor recruitment of patients to the trial. As the success of both treatments were comparable, recruiters and patients focused on pragmatic reasons for choosing the different trial arms, favouring surgery over radiotherapy.[8] Our Head and Neck Unit at NHS Lothian has offered transoral laser microsurgery as a treatment option for early glottic cancer since 2002. Cases are discussed at the MDT meeting and the final decision for the treatment modality is made together with the patient and his or her relatives after counselling by the head and neck surgeon and the oncologist.

Complete histological circumferential en bloc excision was achieved in more than 75 per cent of cases in our cohort. Five patients underwent translesional excision for technical reasons related to surgical access and tumour size and site: tumours were removed in sections starting at one end and working systematically across for to achieve complete resection. Although this resection type is not considered ideal and presents difficulties for histological assessment, studies have demonstrated no sacrifice of oncological control when block-wise resection of the tumour in discrete segments is performed.[9–11] It has also been suggested that for a bulky tumour, removing it in sections has the advantage of

TABLE II
DETAILS OF RECURRENCE CASES

Clinical details	Patient 1	Patient 2
Stage and site (initial)	$T_{1a}N_0M_0$	$T_{1b}N_0M_0$
Histological margins at initial TLM	Clear	Clear
Time to recurrence (months)	19	13
Stage and site (recurrence)	$T_{1a}N_0M_0$	$T_4N_1M_0$
Outcome following recurrence	TLM	Total laryngectomy and neck dissection

TLM = transoral laser microsurgery.

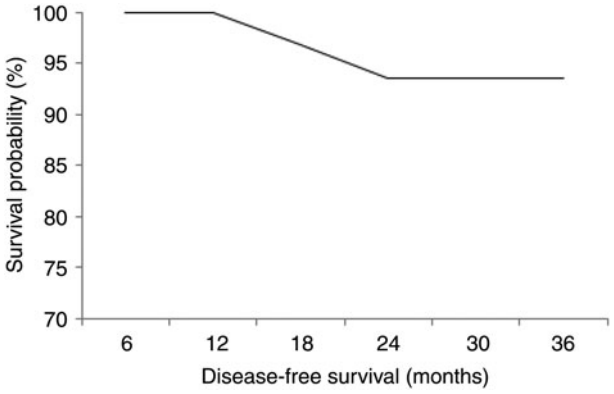

FIG. 1
Kaplan–Meier curve for estimated disease-free survival in glottic cancer patients treated with transoral laser microsurgery.

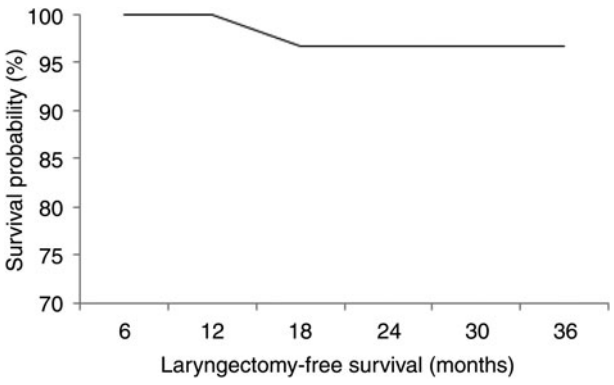

FIG. 2
Kaplan–Meier curve for estimated laryngectomy-free survival in glottic cancer patients treated with transoral laser microsurgery.

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defining the depth of tumour penetration and delineating the deep margin under high magnification.[12] More than half of our specimens were mounted and orientated for pathological examination and most followed the ENT UK recommendation of using the Glasgow technique of mounting the orientated specimen on dehydrated cucumber.[13] This is essential for the pathologist to correctly interpret margin status. Incomplete documentation regarding the surgical procedure could be due to our heavy reliance on photo documentation which is usually done pre-, intra- and post-procedure in the operating theatre. Although these photos were filed in patients' case notes, only a quarter of the photos were accessible during follow-up review.

The ENT UK consensus group agrees that resection margins are surgically adequate when histological analysis shows them to be clear by 1 mm or more.[3] Our histological reporting also complied with the recommended standards for three-dimensional assessments, including the deep margin. However, other factors such as trauma from surgical instruments or tissue handling, artefacts from histopathological slide preparation and thermal damage from laser use can lead to difficulties in margin interpretation.[14,15] The deep margin could not be assessed with confidence in almost 10 per cent of our cases owing to thermal damage. Makki *et al*. reported a significantly higher degree of artefacts with transoral laser microsurgery compared with cold steel excision, which caused difficulty in assessing specimens; however, positive margins could still be confidently interpreted.[16] Interestingly, they found a higher proportion of uninterpretable margins in specimens excised by cold steel.

We performed a second-look procedure in almost 75 per cent of cases, primarily because of doubts regarding surgical margins. Seven residual diseases were detected at routine second-look procedures performed 6–8 weeks after the initial transoral laser microsurgery; all were amenable to further transoral laser microsurgery resection. Within this group, two patients had anterior commissure involvement and required multiple transoral laser microsurgery procedures to achieve clearance. This may be due to the lack of anatomical barriers of the anterior commissure ligament and also difficulties encountered in fully exposing the anterior commissure using conventional laryngoscopes. Our findings are comparable with those of other studies showing an increased incidence of recurrence or residual disease and multiple endoscopic examinations in anterior commissure disease.[17–19]

We performed transoral laser microsurgery only on two patients with T_{1b} tumours. This finding reflects our surgeons' concerns about the potential danger of extensive web formation due to the development of opposing wound surfaces, especially in the anterior commissure region. The possibility of the T_{1b} tumour patients requiring extended cordectomy before undergoing transoral laser microsurgery, especially involving resection of bilateral arytenoids, tends to disqualify them from selection for transoral laser microsurgery treatment. Our observation is that those who underwent resection of both arytenoid cartilages experienced severe post-operative aspiration and dysphagia. However, a recent study by Taylor *et al*. showed that patients with T_{1b} tumours can be effectively treated with transoral laser microsurgery, with oncological outcomes appearing to be superior compared with external beam radiotherapy.[20] They found voice quality to be similar between both groups.

- **Our current transoral laser microsurgery practice for early glottic cancer complies with ENT UK Head and Neck Group standards**
- **The two-year disease-free and laryngectomy-free survival rates of 93.5 per cent and 96.8 per cent, respectively, reflect good oncological outcomes**
- **Transoral laser microsurgery is an acceptable treatment alternative to external beam radiotherapy for early glottic cancer**

Complications from transoral laser microsurgery in our cohort were found in only two cases, both involving the anterior commissure. Both patients underwent repeated microlaryngoscopy examination for web formation, scarring and granulation tissue. Disease-free survival at 18 and 24 months was 96.8 per cent and 93.5 per cent, respectively. Our laryngectomy-free survival rate was 96.8 per cent at both 18 months and 2 years. These oncological outcomes are comparable with those of other published studies.[21–23]

Conclusion

These results provide a good overview of our current practice of transoral laser microsurgery for early glottic cancer when compared with standards outlined by the ENT UK Head and Neck Group, but do highlight several areas for improvements such as surgical and photo documentation. Oncological outcomes are encouraging and confirm that transoral laser microsurgery is an acceptable treatment alternative to external beam radiotherapy for early glottic cancer.

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