

Original Research Article

Transoral laser microsurgery for supraglottic and hypopharyngeal squamous cancers

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ABSTRACT

Background: Open partial laryngectomies for supraglottic and hypopharyngeal cancers have a very high incidence of aspiration in the post-operative period with resultant delay in restoration of swallowing. The present study examines the functional efficacy and oncological safety of transoral laser microsurgery (TLM) for select subset of T₁/T₂/T₃ squamous cancers of the supraglottis and hypopharynx with freely mobile vocal cords that are easily accessible on suspension microlaryngoscopy.

Methods: This is a retrospective study of squamous cancers of the supraglottis and hypopharynx treated with transoral CO₂ laser resection.

Results: Oncologically, resections performed under the magnification of the operating microscope are safe and yield high local control rates ranging from 79% to 85% for supraglottic cancer and from 63% to 89% for hypopharyngeal cancer.

Conclusions: Transoral laser microsurgery (TLM) in selected cases of supraglottis and hypopharyngeal squamous cancers is safe procedure with several advantages over the open partial laryngectomy procedures as also over radiotherapy.

Keywords: Transoral laser microsurgery, Supraglottic and hypopharyngeal carcinoma, Oncological results, Functional outcome, Organ preservation

INTRODUCTION

The cancers of the hypopharynx and larynx are called hypopharyngeal and laryngeal cancers respectively. Both the cancers are usually discussed together because of the close association between the 2 structures. Hypopharyngeal carcinoma exhibits the following symptoms: pricking sensation in the throat, referred otalgia, and hoarseness of voice and stridor which shows spread to the laryngeal structure.¹

Laryngeal cancers are further divided into 3 categories: supraglottic cancer, glottic cancer, subglottic cancer.

The symptoms include, throat pain, referred pain in the ear, dysphagia in addition to weight loss, respiratory obstruction and laryngitis which appear late.²

Etiological factors include cigarette smoking, various genetic factors, occupational exposure to asbestos, mustard gas and tobacco chewing. Cigarette smoke contains benzopyrene which is carcinogenic in man.³ Diagnosis is made on the basis of history, indirect laryngoscopy, CT scan and various other radiological investigations. The tumor spreads via local, lymphatic and hematogenous pathways and the tumors are classified on the basis of the spread in TNM staging. Open partial

laryngectomies for supraglottic cancers have a very high incidence of aspiration in the post-operative period with resultant delay in restoration of swallowing. This is even more so for the voice conserving open resection for hypopharyngeal cancers. Majority of early supraglottic and hypopharyngeal cancers are treated with radiotherapy or chemoradiotherapy. The present study examines the functional efficacy and oncological safety of transoral laser microsurgery (TLM) for select subset of T₁/T₂/T₃ squamous cancers of the supraglottis and hypopharynx with freely mobile vocal cords that are easily accessible on suspension microlaryngoscopy.

METHODS

Study design: This is a retrospective study of squamous cancers of the supraglottis and hypopharynx treated with transoral CO₂ laser resection.

Study place: The study was done in the Department of Surgical Oncology at Prince Ali Khan Hospital, Mumbai.

Study period: The study was conducted between May 1997 and April 2017 where a total of 212 cases of previously untreated squamous cancer of supraglottis and the hypopharynx were resected transorally with the CO₂ laser in the department of surgical oncology, Prince Ali Khan hospital, Mumbai.

Selection criteria: Only a select subset of T₁/T₂/T₃ supraglottic and hypopharyngeal squamous cancers with the following characteristics were taken up for transoral laser microsurgery:

- Superficially invasive previously untreated squamous cancers with freely mobile vocal cords
- Minimal or no invasion of laryngeal spaces
- Accessible to transoral laser resection with good exposure on suspension microlaryngoscopy.

Majority were marginal zone cancers. All the T₃ lesions selected for TLM were T₃ by virtue of their size or trans regional extension. There was no invasion of laryngeal spaces and vocal cords were freely mobile.

Presence of lymph node metastasis did not preclude TLM for the primary.

Cases of transoral laser resection with benign tumours, non-squamous cancers, recurrence of an already treated cancer and simultaneous second primary tumours were not included in this study:

Procedure

Operative technique

Trans oral laser microsurgery was performed under general anesthesia with orotracheal intubation. Exposure

was achieved using a distending laryngopharyngoscope (Steiner's bi-valved adjustable laryngopharyngoscope) with integrated tube for plume suction. A CO₂ laser system (40c, Lumenis, Germany) was used with a micromanipulator attached to the operating microscope. The laser power used varied from 7 W to 15 W super pulse.

A small lesion is resected en bloc. A large lesion may seem very formidable to resect, but the procedure keeps getting easier as one starts resecting segment by segment. For a lesion in close proximity to or even overlying the arytenoid, the cartilage is preserved by resecting the lesion through the supple submucosal plane. This preserves the posterior glottis bulk and prevents aspirations. A suction cautery is an absolute necessity for resecting supraglottic and hypopharyngeal cancers.

All resections were performed with curative intent and not just for debulking of tumour.

If the neck was N+ clinically or on imaging a neck dissection was performed either simultaneously or after an interval of 4-5 days. If the neck was N₀ a "wait and watch policy" was followed and neck dissection performed only when neck metastasis manifested.

Adjuvant treatment with radiation or chemoradiation was only given if the neck disease so demanded for capsular invasion or for N₂/N₃ disease. The larynx and hypopharynx were shielded from the radiotherapy field as much as possible.

Ethical consideration: An informed consent was taken from all the patients before performing the surgery after explaining all the details of the procedure and its benefits and complications. The study design was approved by the ethical committee of Prince Ali Khan Hospital, Mumbai.

Statistical methods: All survival rates were calculated using the Kaplan–Meier method. Events included local and regional recurrences; distant metastasis; and deaths due to disease.

RESULTS

Out of 212 total cases 140 were male, 72 female. Age ranging from 22 years to 84 years (median 53 years). Median follow-up was 54 months (range 24 to 140 months).

According to the TNM staging, 42 patients of supraglottic cancer and 23 patients of hypopharyngeal cancers belonged to stage I while 56 patients of supraglottic cancer and 21 patients of hypopharyngeal cancer belonged to stage II. 16 patients of supraglottic cancer and 15 patients of hypopharyngeal cancer belongs to stage III whereas 17 patients of supraglottic cancer and 22 patients of hypopharyngeal cancer belonged to stage IV.

Table 1: Tumor size.

T-size	Supraglottic cancers (n=131)	Hypopharyngeal cancers (n=81)
T ₁	46	29
T ₂	66	34
T ₃	19	19

Table 2: Lymph node involvement.

N-status	Supraglottic cancers (n=131)	Hypopharyngeal cancers (n=81)
N ₀	111	55
N+	20	26

Table 3: TNM Staging of the cases involved in the study.

Stage	Supraglottic cancers (n=131)	Hypopharyngeal cancers (n=81)
I	42	23
II	56	21
III	16	15
IV	17	22

Table 4: Treatment modality.

Treatment	Supraglottic cancers (n=131)	Hypopharyngeal cancers (n=81)
TLM	111	55
TLM with neck dissection	2	4
TLM with neck dissection and adjuvant (chemo) radiation	18	22

166 patients (111 supraglottic and 55 hypo pharyngeal cancers) were given TLM while 6 patients (2 supraglottic and 4 hypopharyngeal cancers) were given neck dissection in addition to TLM. 40 patients (18 supraglottic and 22 hypo pharyngeal cancers) were given a combination of TLM with neck dissection and adjuvant chemoradiation.

Table 5: 2 year local control rate for supraglottic cancers.

pT	pT ₁	pT ₂	pT ₃
Local control rate (%)	85	84.61	78.94

Table 6: 2 year local control rate for hypopharyngeal cancers.

pT	pT1	pT2	pT3
Local control rate (%)	88.8	78.12	63.15

Oncologically, resections performed under the magnification of the operating microscope are safe and yield high local control rates ranging from 79% to 85% for supraglottic cancer (Table 5) and from 63% to 89% for hypopharyngeal cancer (Table 6).

Table 7: Recurrences in supraglottic cancers (n=35).

Recurrence site	Local	Loco-regional	Regional	Distant
Number	19	7	8	1

Table 8: Recurrences in hypopharyngeal cancers (n=26).

Recurrence site	Local	Loco-regional	Regional	Distant
Number	8	5	8	5

Of the 61 recurrences (35 supraglottic cancer and 26 hypo pharyngeal cancer), 10 were salvaged with repeat TLM, 4 with combination of TLM and neck dissection, 2 with TLM combined with Radiotherapy. 1 patient was treated with triple therapy consisting of TLM, Neck dissection and radiotherapy. 9 patients were salvaged with neck dissection while 2 were given radiotherapy in addition 2 neck dissection. 11 patients were treated with radiotherapy, 08 with total laryngectomy and 14 patients were given palliative treatment (Tables 7, 8 and 9).

46 patients (21.7%) with clinically 'N+' neck at presentation, underwent neck dissection at same time of TLM or after interval of 4-5 days. For the 166 (78%) 'N0' cases, the neck were treated only if and when metastasis manifested at follow up. Thus 16 patients underwent neck dissection for regional recurrence at follow-up. The neck was also treated in the local/loco-regional recurrences salvaged either with radiotherapy or total laryngectomy.

Organ preservation in supraglottic cancers could be achieved in 39 cases (92.85%) of stage I, 54 cases (96.42%) of Stage II, 15 cases (93.75%) of Stage III and 8 cases (47.05%) of Stage IV.

Organ preservation in hypopharyngeal cancers could be achieved in all cases (100%) of stage I and II, 13 cases (90.9%) of stage III and 19 cases (86.36%) of stage IV.

Functional results:

Most of the patients had an easy postoperative recovery phase. None of the patients needed a tracheostomy. Very few patients needed a feeding tube for 2-3 days postoperatively and this was generally not for aspiration but rather for odynophagia as a result of a large raw area in the hypopharynx or the vallecula following resection. Only one patient needed a feeding gastrostomy for prolonged period.

Table 9: Salvage therapy after the first failure.

Treatment	Supraglottic cancers n=35 (26.71%)	Hypopharyngeal cancers n=26 (32.09%)
Repeat TLM	9	1
TLM + neck dissection	3	1
TLM + RT	1	1
TLM + neck Dissection + RT	1	0
Neck dissection	4	5
Neck dissection+ RT	1	1
RT	4	7
Laryngectomy	6	2
Palliative	6	8

DISCUSSION

Open supraglottic partial laryngectomy and supracricoid partial laryngectomy with cricothyroidopexy, procedures that were often undertaken for early or intermediate stage supraglottic cancers are rarely resorted to today because of the prolonged periods of aspiration following surgery and because of the availability of effective non-surgical treatment options via advanced techniques in radiotherapy and a combination of chemo and radiotherapy.^{4,5} The problem of postoperative aspiration following open voice conservation surgery was even more pronounced in early hypopharyngeal cancers.⁶ So much so that the world over, most centres treated these cases only with non-surgical treatment of radiotherapy or chemo radiation. If ever a surgical option was considered, it was either a total laryngectomy or a near-total laryngectomy even for an early cancer of the hypopharynx. The advent of transoral laser micro surgery (TLM) has added a new dimension to the treatment options in selected cases of supraglottic and hypopharyngeal (5) cancers.⁷ These are T₁, T₂, T₃ lesions that are superficially invasive, the vocal cords are freely mobile and there is no gross invasion of laryngeal spaces. Most importantly, lesions should be accessible to TLM with good exposure on suspension microlaryngoscopy. Majority of these lesions are located on the marginal zone, the suprahyoid epiglottis, the aryepiglottic folds and the pharyngoepiglottic folds.⁸ With the transoral approach, the main sensory nerve supply to the larynx remains undisturbed and this helps a great deal in preventing aspiration and therefore allows early restoration of swallowing.⁸ Again, with transoral resection, the laryngeal framework remains intact obviating the need for a tracheostomy. Even if the lesion involves the mucosa over the arytenoid, under the magnification of the operating microscope, the tumour can be resected through supple submucosal tissue preserving the arytenoid which allows a good voice quality and also helps in preventing aspiration.^{8,9} It is these advantages of no tracheostomy, no feeding tube and smooth post-operative recovery that allows trans oral

laser resection to be performed as a day care procedure in most cases with significant cost saving.^{9,10}

In the present series of 212 cases, barring one patient who needed feeding tube for a prolonged period, all others have had smooth post-operative recovery with early restoration of swallowing.¹⁰

In terms of disease control the resection performed under magnification of the operating microscope is very effective for local control as evident in the results in this series.

The published results by Bocca et al of open supraglottic partial laryngectomy for T₁/T₂/T₃ squamous cancers are 2-year local recurrence rate of 16.5% (stage I and II) and 21.5% (stage III and IV).¹⁰

It has been argued that such superficially invasive T₁/T₂/T₃ squamous cancers of the supraglottis or the hypopharynx can also be very effectively treated with the non-surgical treatment methods via radiotherapy for smaller lesions or chemoradiation for the bulky lesions or those with N+ neck.¹¹ While this is true, it is also a fact that radiotherapy and chemoradiotherapy are more prolonged, more expensive and more toxic treatments they can cause severe mucositis and have long term side effects of dryness of the mucosa.¹² Moreover recurrences following radiotherapy cannot be re radiated. These cases need salvage total laryngectomy with very high complication rates because of poor healing and pharyngeal leak.¹³ As against this if the primary is resected with laser, the larynx and hypopharynx are spared radiotherapy and it's after effects. In case of recurrence following laser resection, all the treatment options are available for treating the recurrence including re-resection transorally with the laser or radiotherapy or open surgery. In this present cases of 212 cases treated with TLM 151 cases (71%) remained recurrence free. Of the 44 cases (20.7%) who developed local or loco regional, 17 cases (38.6%) were salvaged with repeat TLM and 11 (25%) with radiation therapy. Eight patients with local/loco regional recurrence could only be salvaged with total laryngectomy. Another 8 patients had very advanced loco regional recurrence and could only be offered palliative treatment.

Overall, treatment with TLM is effective in yielding high local control rates that are no inferior to radiotherapy or chemoradiotherapy with advantages of a shorter treatment time, much better tolerance and devoid of long term side effects.

Another argument followed by the proponents of treatment with radiotherapy over preference of TLM is that radiation for supraglottic and hypopharyngeal cancers includes the cervical lymph nodes in the treatment fields since these cancers have high propensity for lymph node metastasis.¹⁴ Prophylactically radiating the neck while radiating the primary has been a standard

practice for several decades and needs to be challenged. If the neck is N+ at presentation, it is best to do neck dissection rather than radiate. In the present series 46/212 cases were 'N+' at presentation and underwent neck dissection either at same sitting as TLM or 4-5 days later. Forty of these were treated with adjuvant radiotherapy because the neck disease so demanded. The larynx was shielded in as far as possible. In the remaining 166/212 cases (78.3%) cases, the neck was 'N₀' at presentation both clinically and on imaging. These were treated with TLM alone. Rather than subject this very large group of 'N₀' cases to prophylactic treatment of the neck with radiotherapy or neck dissection, the authors prefer to pursue a vigilant "wait and watch" policy with regular follow-up, resorting to neck dissection only if and when lymph node metastases manifest. At follow up 16 patients who developed cervical lymph node metastasis underwent neck dissection with 12 of this receiving adjuvant radiotherapy. As mentioned earlier 8 patients developed advanced unresectable loco-regional recurrence and could only be offered palliative treatment. Some of these patients with local recurrences who underwent salvage treatment with radiotherapy or total laryngectomy, also had cervical lymph node metastasis that were tackled simultaneously with salvage of the primary.

All in all, by not radiating the neck prophylactically and instead following the 'wait and watch' policy, the failure rate in the neck has been kept to the bare minimum. In more than 100 cases prophylactic treatment of neck has been avoided along with its inherent complications.

CONCLUSION

Transoral laser microsurgery (TLM) in selected cases of supraglottis and hypopharyngeal squamous cancers is safe procedure with several advantages over the open partial laryngectomy procedures as also over radiotherapy. In T1/T2/T3 cancers that are superficially invasive, the vocal cords are freely mobile, there is no gross invasion of the laryngeal spaces and there is adequate tranoral access, the resection performed under the magnification of the operating microscope is oncologically safe and functionally very well tolerated. Functionally following TLM tracheostomy is not needed and problems of aspirations in post-operative period are minimal, if at all. These are major advantages of TLM over the open partial laryngectomy procedures. As compared to treatment with radiotherapy, TLM has a much shorter treatment time and is devoid of long term sequelae of dryness of the mucosa. In case of local recurrence, TLM can be repeated whereas radiotherapy cannot be and often the only alternative is total laryngectomy. Oncologically, TLM is safe because the resections are performed under the magnifications of the operating microscope. For management of neck, following TLM if the neck is clinically 'N+' it is dissected at the same time or after interval of 4-5 days. If the neck is clinically 'N₀' a wait and watch policy is

followed after TLM and treatment of the neck undertaken only if and when metastatic disease manifests. With this approach failures in neck are kept to bare minimum. As against this, if the treatment is with radiation therapy, the 'N₀' neck receives prophylactic radiation bilaterally.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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