

Original Research Article

Role of lasers in glottic malignancies: our experience

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ABSTRACT

Background: Laryngeal malignancy is one of the commonest head and neck cancers encountered in India. Most tumors are glottic in origin. Radiation, partial or total laryngectomy gives very good cure rates for these tumors. Lasers have emerged as an integral part of the treatment paradigm for patients with laryngeal cancer. Laser surgery is one of the primary treatment options for early-stage glottic tumors and can also be used for advanced laryngeal tumors.

Methods: Fifty patients with laryngeal cancer were treated with laser over a 10-year period. Majority of patients were males with an average age of 46 years. Most patients had early (T1, T2) laryngeal malignancy (90%). There were a few patients with advanced laryngeal tumor (10%). All patients had tumor biopsy and simultaneous laserization of the tumor followed by radiation in T1 and T2 disease and chemo radiation in T3 disease. A few patients who had recurrence of disease after radiation (4%) were medically unfit for laryngectomy and underwent laserization of the tumor.

Results: Laser surgery proved to be an important tool in the management of glottic tumors and is commonly utilized in the treatment of early-stage disease. It has also been successful for debulking of large tumors. Careful case selection is important for good outcomes.

Conclusions: Transoral laser microsurgery and radiotherapy are useful treatment modalities in the management of early glottic malignancies. Lasers have proved to be effective in glottic malignancies with excellent oncologic and functional outcomes.

Keywords: Lasers, Glottic malignancies, Radiation

INTRODUCTION

Laryngeal malignancies are one of the commonest head and neck cancers in the Indian subcontinent. Glottic carcinoma is the most common subtype.¹ Treatment options include laser treatment, radiation, partial or total laryngectomy and in recent years, transoral robotic surgery.

Over the last four decades, transoral laser microsurgery (TLM) has become an integral part of the management

protocol for patients with laryngeal cancer.² TLM provides good oncologic and functional outcomes because the glottis has sparse lymphatics and tumor can be removed with the laser with close margins and minimal collateral tissue damage.

In TLM, piecemeal removal of tumours using a laser is done under the operating microscope. This is recommended as a single modality treatment for early laryngeal cancers (T1 and T2) and occasionally in more

advanced (T3 and T4) tumors.³ The cure rate for early-stage (T1-2, N0, M0) tumors is favorable.⁴

METHODS

This is a retrospective observational study of fifty patients with laryngeal cancer arising from the glottis who were treated with laser (January 2009 to January 2019) in Madras ENT Research Foundation, a tertiary care centre in Chennai, South India. Majority of the patients were males (48 patients) and two patients were females. The percentage of smokers was 88% (n=44). Inclusion criteria for this study was patients with squamous cell carcinoma of the glottis (T1-T4, N0, M0) and exclusion criteria included patients with malignancy arising from sites other than the glottis and extralaryngeal spread of tumor. All patients underwent a thorough clinical evaluation, endoscopy of the larynx (videolaryngoscopy or videostroboscopy) and CT scans of the neck.

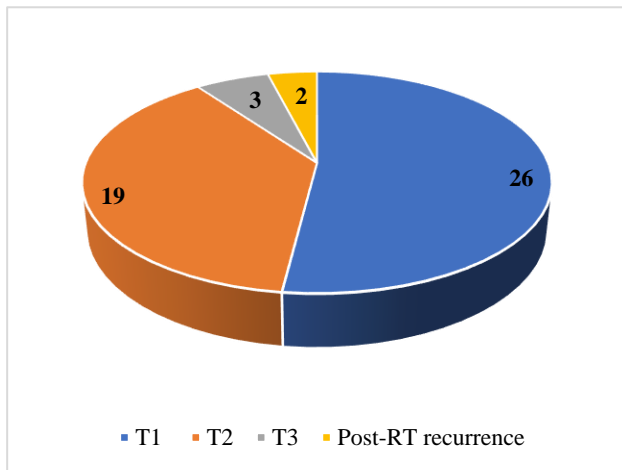


Figure 1: Number of patients with various stages of glottic cancer.



Figure 2: Video laryngoscopy showing left glottic cancer.

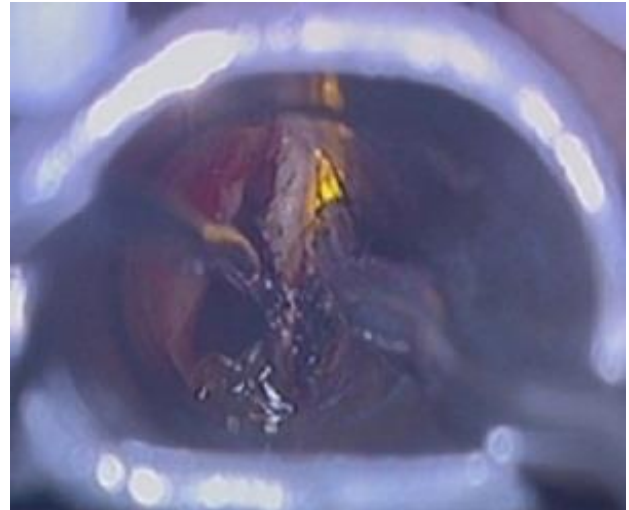


Figure 3: Type 3 cordectomy.



Figure 4: Type 5 cordectomy.

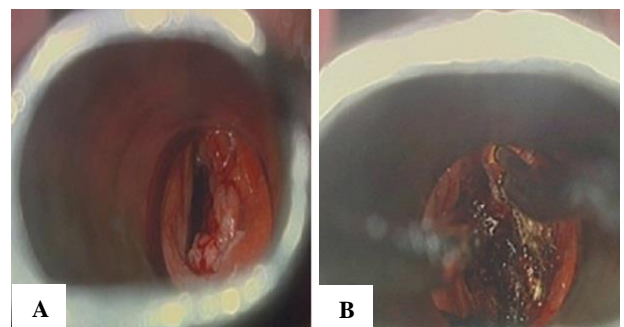


Figure 5: (A) Radiorecurrent tumor; (B) laserization of radiorecurrent laryngeal malignancy.

Most patients (90%) had early stage disease (T1, T2) (Figure 1). In all patients, tumor biopsy and simultaneous laserization with KTP-532 laser was done. Laser cordectomy was done as per the European Laryngological Society classification.⁵ Patients with T1

(Figure 2) and T2 disease underwent laserization followed by post-op radiation (RT) (Figure 3 and 4). Patients with T3 disease underwent laserization followed by chemo RT. Patients with radio-recurrence who were not medically fit for laryngectomy also underwent tumor laserization (Figure 5 A and B). All patients were advised periodic long-term follow-ups after the treatment.

RESULTS

Fifty patients with glottic cancer were treated with Laser in a tertiary care centre between January 2009 to January 2019. In this series, there were 48 men (96%) and two women (4%) with an age range as shown in Figure 6. Patients with T1 and T2 disease (90%) underwent laser cordectomy followed by post-op radiation. Patients with T3 disease (6%) underwent laserization followed by chemoradiation. Patients with radio-recurrent tumor (4%) who were not medically fit for laryngectomy also underwent tumor laserization. The outcomes of treatment are as shown in Figure 7. Patients with T1 and T2 glottic cancer had good 5-year disease control and 5-year survival rates compared to patients with advanced disease. TLM proved to be a useful tool for curing early tumors and for treating larger radio-recurrent laryngeal tumors in patients unfit for surgery. Post-treatment dysphonia was present in 12 patients (24%) (Figure 8). In our series, the average follow-up was 7 years.

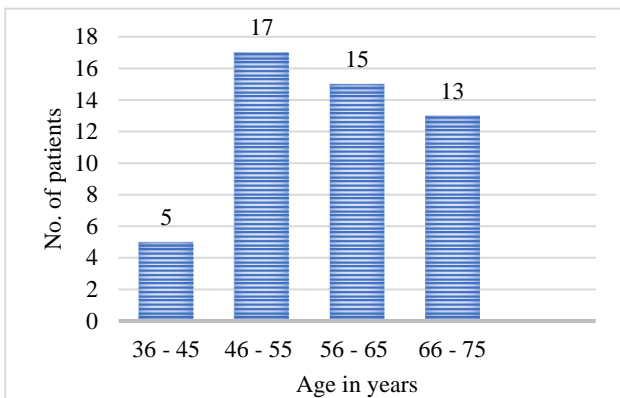


Figure 6: Age range of patients with glottic cancers.

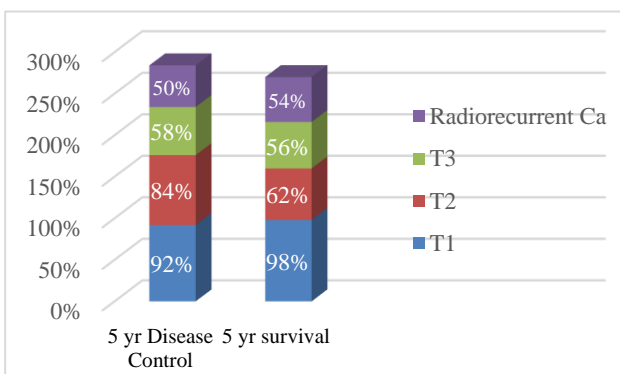


Figure 7: 5-year disease control and survival after treatment for glottic cancer.

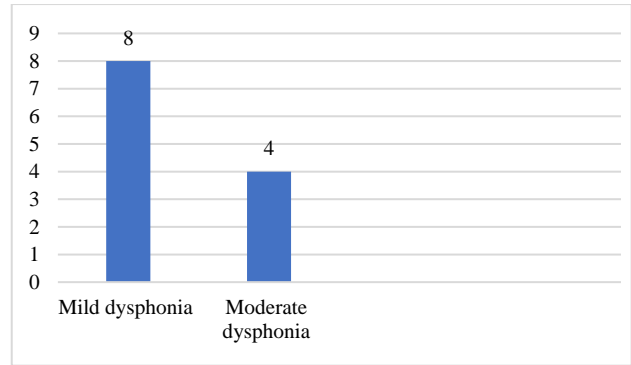


Figure 8: Number of patients with post-treatment dysphonia.

DISCUSSION

There are multiple options described in the literature for treating glottic carcinoma, and these consist of open surgery, TLM, or radiation.¹ There has been a transition from external surgery to endoscopic laser microsurgical techniques which have been possible mainly due to a landmark study by Professor Wolfgang Steiner (1993) and the European Laryngological Society’s (ELS) classification scheme (2000).⁵ TLM is the mainstay of treatment for early glottic carcinoma. Early stage cancer (stages I and II) is generally managed with single modality treatment. For advanced stage (stages III and IV) disease, combined modality treatment is generally preferred.⁶ Transoral laser surgery is the oncologic resection of tumor performed through an endoscopic approach. Lasers have been used in laryngeal surgeries since 1972, when Strong and Jako first reported the use of carbon dioxide laser (CO₂) in the larynx.⁷ In 1975, Strong used the CO₂ laser to treat 11 patients with early T1 laryngeal cancer.⁶

Indications for TLM include tumor oncologically amenable to surgical resection (Ca in situ, T1, T2, and select T3 and T4 tumors) with ability to visualize the tumor through the endoscope. TLM is also useful for palliative tumor debulking and in recurrent laryngeal cancer. The advantages of TLM are precise control of the depth of ablation, with minimal thermal damage to the vocal cords, decreased bleeding, decreased post-operative edema, pain and scarring. The Laser theoretically seals blood vessels and lymphatics. TLM provides excellent oncologic and functional outcomes and does not preclude further options of treatment. TLM enables an individualized surgery, planned according to the size and location of each tumour.⁸ TLM allows targeted resection and tissue sparing, but requires training and surgical equipment. Radiotherapy on the other hand is widely available, can be delivered using standard external beam radiation sources. The disadvantages of radiotherapy include local temporary or persistent edema, glottis stenosis, xerostomia, and hypothyroidism.⁹ There is also a small risk of radiation-induced malignancy.

The most important factor in laser surgery is to get adequate exposure of the tumor during microlaryngoscopy. A T1a tumor requires a type II cordectomy, a T1b tumor is managed by a type III resection and a T2 tumor requires a type IV cordectomy.¹⁰ TLM has a lower incidence of complications as compared to open surgery, such as a decrease in the need for tracheostomy and lower post-operative morbidity. Although TLM has historically been performed with a carbon dioxide laser, potassium titanyl phosphate (KTP) laser has also been used for glottic carcinoma. The KTP laser is absorbed by red pigment such as hemoglobin, hence it is an excellent instrument for selectively vaporizing tissues that are highly vascularized (selective photoangiolysis).¹ The tumor is removed in sections; thus, the precise depth of tumor invasion can be defined. The aim of the treatment should be function preservation with good oncological outcomes.¹¹ For the glottic larynx, 1 to 3 mm margin may be adequate. For patients undergoing TLM after radiation failure, even larger margins of resection become necessary.¹² Intra-operative frozen sections may be used to ascertain margin status. Contraindications for TLM include limiting anatomic factors which include trismus, cervical spondylosis, large tongue base, prominent dentition and anterior larynx. Other contraindications include marked extension of the primary tumor and nodal disease merged or encased around the great vessels, risk for aspiration (bilateral arytenoid invasion), subglottic extension >5 mm, postcricoid extension, invasion of pyriform sinus, cartilage invasion, vocal fold fixation (relative) and involvement of the tongue base (relative).

Early glottic cancer is not generally associated with neck metastasis; hence neck treatment is routinely not considered.¹³ TLM and RT offer comparable cure rates for early (T1 and T2 tumors) glottic tumours. Anterior commissure involvement is generally associated with worse outcomes.¹⁴ In a study by McClelland et al, in 22 patients who were treated for early glottic carcinoma with TLM, the 5-year local control rate for T1 tumours was 89% and 56% for T2 tumours. The laryngectomy rate was 4.5% and the mortality rate from local and distant disease was 4.5%. 45% of patients in this study had mild or moderate voice change.¹⁵ The quality of voice after TLM depends on the degree of resection required and more superficial tumours have a better outcome.¹⁵ In a study by Ahmed et al, the laryngeal preservation rate for patients who initially received KTP laser treatment was 46 out of 47 patients (98%).¹ Of the cohort who received primary radiation, the laryngeal preservation rate was 36 out of 40 patients (90%). Disease-free and overall survival were 88% and 98% in the KTP laser group and 85% and 95% in the radiation group respectively. They concluded that KTP laser treatment is equivalent to primary radiation therapy in oncologic outcomes for T1 glottic squamous cell carcinoma.¹ Since the glottis has sparse lymphatics, laserization with close margins results in good oncologic and functional outcomes.¹

According to a study by Horwich et al, TLM does not result in a lower rate of locoregional control and overall survival of patients after total laryngectomy.¹⁶ As per a study by Ahmed et al, KTP assisted TLM results in good functional outcomes.¹ It has been reported that for early lesions of the glottis, single modality treatment in the form of radiation or surgery offers comparable voice outcomes. No significant difference in overall survival, disease free survival, or local control is seen between TLM and RT. Siddiq et al reported that the 5-year disease-specific survival rates for the local surgery and local surgery and radiation groups was reported to be 91% and 90%, respectively and the 5-year survival rate for the radiation only group was 83%.¹⁷ Voice quality outcomes are reported to be better for ELS 1 and 2 resections and equivalent to RT compared to extended / deeper resections (ELS 3-6) and vocal function may return to pre-operative levels in patients who undergo type III cordectomy.¹⁷ The use of the laser for cytoreduction helps achieve good outcomes.¹⁸ For T3 tumors, chemoradiotherapy is the mainstay of treatment and for T4 disease, the treatment of choice is surgery followed by radiotherapy.¹⁹ In patients with advanced laryngeal cancer, TLM with or without radiotherapy is a treatment strategy for organ preservation especially in patients unfit for surgery.²⁰ TLM has been reported to be an effective option for recurrent laryngeal cancer after radiotherapy failure in terms of high incidence of overall survival, local control, and organ preservation.²¹

In our study, the 5-year disease control and 5-year survival was good in patients with early tumors and post-op dysphonia was noted in 12 patients (24%). All patients underwent biopsy and laserization followed by RT because of the problems of follow-ups and distance from the treatment centre. In the Indian context, attrition rates for follow up are high and tumor surveillance becomes difficult.

CONCLUSION

Over the past three decades, organ preservation modalities like TLM and RT have played a key role in the management of early glottic malignancies and have influenced a change in oncological practice worldwide. However, there is a significant debate among clinicians as to which of the two modalities is a better treatment option for early glottic malignancies with literature reviews showing comparable cure rates. With growing clinical knowledge and surgical experience, TLM has emerged as an optimal approach in early laryngeal cancer and is also useful for select patients with advanced tumors. Careful and appropriate case selection is crucial for good outcomes.

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