

Nd:YAG laser therapy of carcinoma lip (stage I squamous cell carcinoma): a retrospective evaluation

Gautam Bir Singh · Mallika Tiwari · H. S. Shukla · Manoj Pandey

Abstract

Objective To assess the efficacy of Nd:YAG laser for stage I squamous cell carcinoma of the lip. To the authors' knowledge this is the first reported study on this subject.

Study design Retrospective study design involving treatment of 46 patients of either sex of stage I squamous cell carcinoma of lip over a 10-year period in a single tertiary care university teaching hospital with Nd:YAG laser.

Methods Nd:YAG laser ablation of lesions in lip was carried out in all the patients on an OPD basis with prior consent. A regular follow-up was maintained for a period of 5 years. A negative biopsy at the end of one month and one year was considered a treated case. The tabulated data was analysed statistically by "Kaplan Meier" method and "Log Rank" test. Also cosmetic and functional results were assessed by any sign of flow away after filling the oral cavity with water and postoperative integrity of facial nerve in accordance with "House Brackmann" classification.

Results In this series of 46 patients, 35 patients were disease free at the end of 3 years and this number further declined to 29 at the end of 5 years with 4 deaths and 2 more patients lost to follow-up. The statistical evaluation by Kaplan Meier method gives us an overall 5-year survival rate of 88.14% with a mean survival of 58 months. Further 8 patients required repeat laserization either for residual or

recurrence of lesion. Also 2 patients had a lymph node metastasis during the follow-up period. Thus, by applying Kaplan Meier method recurrence-free survival (RFS) and disease-free survival was found to be 85.1% (mean: 55 months) and 73.34% (mean: 57 months) respectively. Interestingly on applying Log Rank test it was observed that the site of the lip involvement, i.e. whether upper or lower had no influence on disease-free survival. It was also observed that history of tobacco intake did not influence the disease free survival either (Log Rank Test). Moreover the cosmetic results were excellent and with no significant complication observed.

Conclusion The results reported here support the use of Nd:YAG laser for treatment of Stage I squamous cell carcinoma of lip in accordance with principles of minimal invasive and morbid surgery.

Keywords Carcinoma lip · Nd:YAG laser · Squamous cell carcinoma

Introduction

The modern otolaryngologist is increasingly involved in addressing the issue of carcinoma lip, as it is the commonest site of cancer in mouth [1]. Radiotherapy and surgery are the main stay of treatment for the said carcinoma. However the modality of treatment for lip carcinoma should not only cure the lesion but also include consideration of functional as well as cosmetic criteria. At present radiotherapy is regarded superior to surgery in this context [2]. The use of laser in carcinoma lip is shrouded in controversy although it gives excellent cosmetic results. We present a large single center experience with use of Nd:YAG laser in select group of carcinoma lip cases in a retrospective study design. The central aim of the study was to evaluate the therapeutic efficacy of the said laser. In this study we have used qualitative methodology to explore an area that has not been previously subjected to research.

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Materials and methods

With the approval of our institutional board medical records of 46 patients of lip cancer – squamous cell carcinoma (SCC) stage I, treated with Nd:YAG laser were reviewed and evaluated from Jan 1991 to Jan 2000. Follow-up records were maintained in the Department of Surgical Oncology, Institute of Medical Sciences, Banaras Hindu University, Varanasi - a tertiary care university teaching hospital.

All the patients had consented for the said treatment and the following inclusion criteria was strictly adhered to while imparting laser treatment in accordance to the general principles of laser therapy:

- Karnofsky status of 70% or above
- Histopathologically proven lesion of squamous cell carcinoma
- Only T₁N₀M₀ lesions, i.e. not more than 2 cm in greatest dimensions with no lymph node involvement and metastasis were recruited for treatment (patients with stage II or bony involvement were excluded)
- Computerized tomography scan was mandatory to rule out any underlying bone or lymph node involvement.

Any patient with recurrence of carcinoma or having undergone or undergoing any other modality of treatment for the cancer of lip was excluded from the treatment protocol.

Intervention was done in the form of laserization in all cases. This was carried out as an outpatient procedure under local anesthesia. The power of the Nd:YAG laser was set between 30–50 watts and duration of the pulse at one second, at pulsed mode. The lesion was fully coagulated with the laser. This was followed by surface cooling of the lesion for maximum absorption of heat in the lesion. The entire lesion was coagulated in a punctate manner at 8 mm of interval for 1–2 seconds each. The fulgurated site was left to granulate and undergo healing by secondary intention. All the necessary safety protocols for laser treatment were strictly adhered to, and precautions were taken to avoid explosions, eye and skin injuries.

In the post-laserization period, patients were prescribed analgesics (ibugesic+paracetamol combination for 5 days) and mouthwash only. Patients were also encouraged to take normal meals after the procedure.

Patients were kept on a regular follow-up in the surgical oncology department on 7th day, 30th day, and thereafter monthly till one year. In accordance with the principles of laser management, a repeat biopsy of the treated lesion was done at the end of one month (for residual lesion) and one year (for recurrent lesion). In case, the scrutiny of the laser wound showed suspicious signs of malignancy during the one year follow-up, this biopsy was preponed. A healthy laser wound with both biopsies negative was considered a successfully treated case at the end of one year. Thereafter

a yearly follow-up was maintained till a period of 5 years post-laserization.

Looking for any sign of flow away after filling the oral cavity with water checked the functional lip closure at the end of 3 months [3]. The integrity of facial nerve was evaluated in all the cases postoperatively using House Brackmann classification [4].

All results were tabulated and analysed using Kaplan Meier method and Log Rank test [5].

Results

In our series of 46 patients 31 were males and 15 were females. The age group ranged from 18 years to 80 years. As expected a preponderance of carcinoma was seen in lower lip – 34 cases. A history of tobacco ingestion in any form was recorded in 37 cases. Out of these 46 cases, 5 cases had residual lesion at the end of 1 month. Three cases had recurrences in 9, 14 and 20 months during follow-up after laser treatment. However no case required more than two sittings of laser therapy. Unfortunately thereafter a high drop out rate was seen in our retrospective study design. Only 35 cases turned up at the end of 3-year follow-up, all were healthy with no sign or symptom of the dreaded malignancy. This number further declined to a mere 29 at the end of 5-year follow-up. Four of our 35 cases died a natural age dependent death and 2 cases were untraceable. These 29 cases were healthy and tumor free. However two cases developed lymph node metastasis in the 2nd year of follow-up and were managed with elective neck dissection. Both the cases completed their 5-year follow-up with no recurrence of cancer.

This data was statistically analysed using Kaplan Meier method:

- The overall 5-year survival rate (SR) was found to be 88.14% (Fig. 1), however the 3-year SR was 100%. The mean survival in this series was 58 months.
- The recurrence free-survival for 5 years was 85.1% and the mean RFS was 55 months (Fig. 2).
- The disease-free survival rate (DFSR) was 73.34% and the mean DFSR was 56 months (Fig. 3).
- Interestingly DFSR for upper lip was 80.21% (mean: 57 months) and for lower lip was 70.71% (mean: 56 months) (Fig. 4), on applying Log Rank test the value of $P = 0.59$, which is not significant. Hence the site has no relationship with DFSR.
- Also DFSR for patients with no history of tobacco intake was 100%, where as for patients consuming tobacco in any form it was 67.3% (Fig. 5). Again on subjecting this data to Log Rank test the value of $P = 0.09$, which is not significant. Thus, tobacco consumption does not influence the outcome of DFSR in the present study.

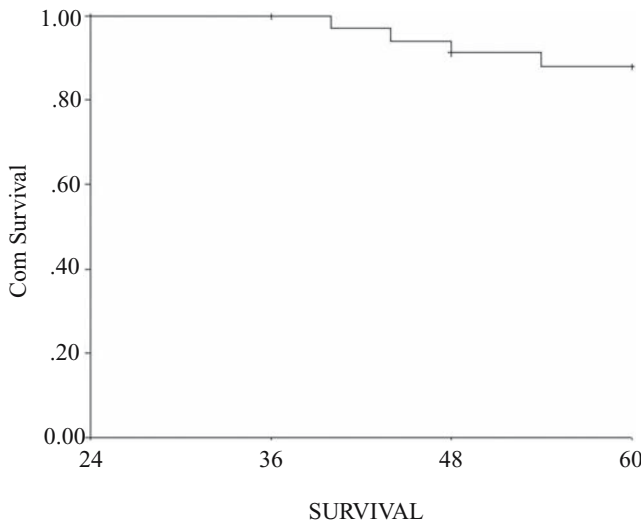


Fig. 1 Kaplan Meier curve showing overall 5-year survival (in months) in patients treated with Nd:YAG laser

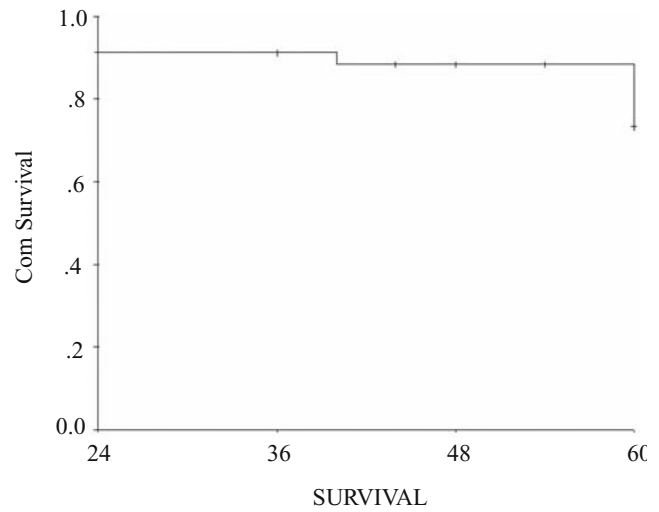


Fig. 3 Kaplan Meier curve showing disease-free survival (in months) in patients treated with Nd:YAG laser

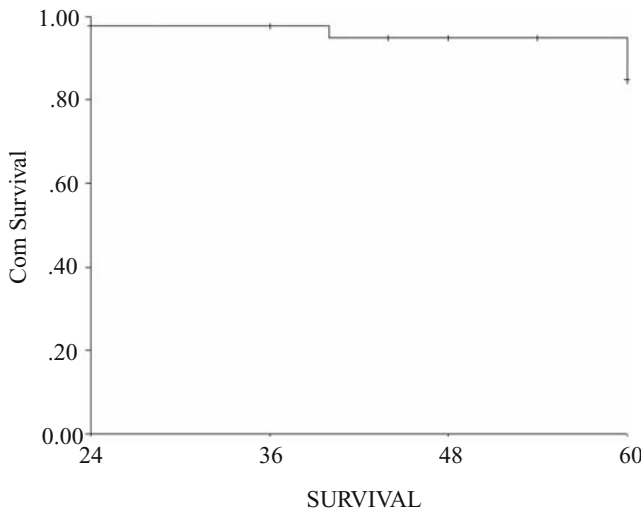


Fig. 2 Kaplan Meier curve showing recurrence-free survival (in months) in patients treated with Nd:YAG laser

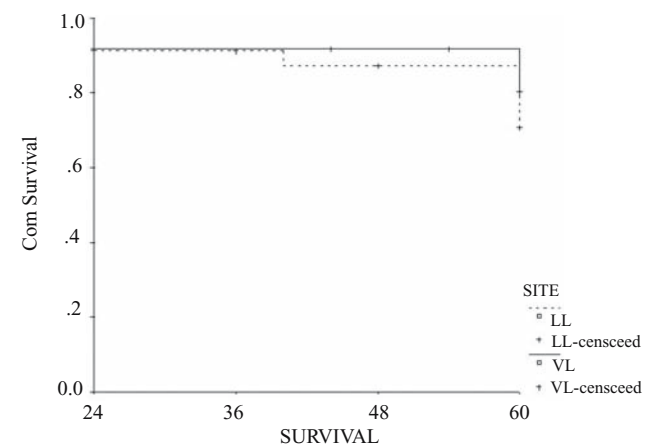


Fig. 4 Kaplan Meier curve showing disease-free survival (in months) in patients treated with Nd:YAG laser on the basis of site (upper/lower lip) of lesion

It is pertinent to note that all the cases in follow-up had a normal closure and good cosmetic result as tested by the simple water test in the oral cavity. No alteration in facial expressions was observed (i.e. facial nerve was normal post-laserization). Also no case of parathesias or postoperative infection was seen.

Our results would be incomplete without addressing the issue of adverse effects associated with Nd:YAG laser therapy in this study. All the patients in our series had mild postoperative pain requiring small doses of analgesics for only 5 days. However edema was recorded in all the cases but resolved without any specific treatment within a month of the treatment, i.e. on the first follow-up monthly visit, no edema was observed.

No other intraoperative or postoperative complication of any type was recorded in this series of patients.

Discussion

As compared to conventional modalities of treatment for oral cancer, laser offers certain advantages: improved visibility, hemostasis, decreased postoperative pain and edema [6]. Local control 5-year survival rates and postoperative function with the laser are comparable to other methods of extirpation. It is pertinent to note that laser also have the precise ability to remove mutagenic clones from oral mucosa as they develop and thereby prevent development of cancer in situ [7].

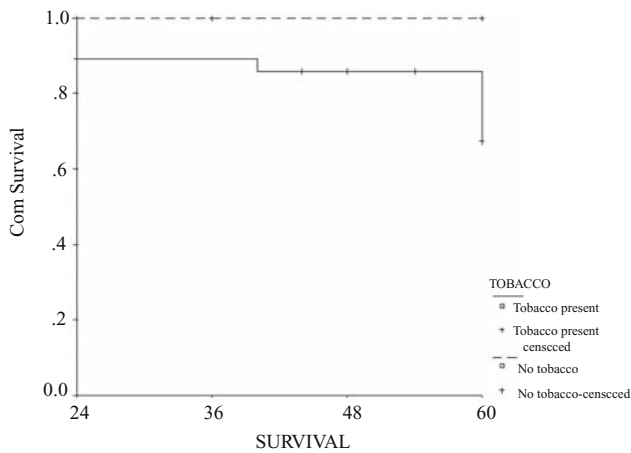


Fig. 5 Kaplan Meier curve showing disease-free survival (in months) in patients treated with Nd:YAG laser on the basis of history of tobacco intake



Fig. 6a and b A patient of carcinoma lower lip treated with Nd:YAG laser

However the current notion is that laser ablative techniques are suitable for dysplastic lesions of lip only as this technique does not distinguish between normal and cancerous tissue and there is no histological control over the mar-

gins of the tumor [3]. Thus not surprisingly scant medical literature exists on the cited subject.

A study by Tradati et al. (1991) highlights the importance of CO₂ laser in squamous cell carcinoma of oral cavity or lip in a series of 51 patients [8]. The study quotes a success rate of 87%. A recent study by Laptev on the use of CO₂ laser in treatment of cancer of lip, lingual mucosa and bottom of the oral cavity observed that best results were attained in the patients with the disease in stage T₁N₀M₀-T₂N₀M₀; 5-year survival rate of 43.3–58.5% [9]. Yet another study by Vinciullo reports the combined use of CO₂ laser vermilionectomy with surgery in cases of carcinoma lip with excellent results [10].

However a strong bias exists against use of Nd:YAG laser in oral cavity, as medical literature states that CO₂ laser as the laser of choice for malignant and malignant lesions of the oral cavity [11]. There is a school of thought suggesting that [12]: Nd:YAG laser causes more pain and edema (due to its greater potential to penetrate deeply and scatter radiation peripherally which can produce partial changes in surrounding tissue), Its penetrative power can cause nerve damage by heat coagulation, prolonged use in the oral cavity can transgress the limits of temporomandibular joint and there is a greater risk of stenosis of salivary gland ostia. We could find only three studies in the English medical literature on the use of this laser in oral premalignant and malignant lesions in oral cavity. These studies by White et al. (1991) [13], Zhao et al. (1991) [14] and Miyaguchi et al. (1994) [15] however have a small sample size of patient population in question, thereby limiting a definitive statistical conclusion. In a massive search using Medline/Pubmed data base using the medical subject function authors could find no study on the exclusive use of Nd:YAG laser as defined here in.

Our overall success rate of 88.14% at the end of 5 years augers well with the local control rate of 80–100% achieved by CO₂ laser in premalignant and malignant lesions of the oral cavity as mentioned in specific literature [8, 16, 17]. In addition our results also match the success rate of greater than 85% reported in stage I carcinoma lip by conventional modalities of treatment [1]. Also a recurrence-free survival for 55 months in a 5-year follow-up study is no less an achievement either.

According to recent literature surgical removal of the tumor results in extensive loss of tissue, as a requisite excision margin of 7–10 mm is required [18]. Moh's surgical technique, no doubt spares more normal tissue with minimal margins but is expensive and time consuming [3]. Although radiotherapy gives better cosmetic result but complications like dermatitis, atrophy, chronic ulceration and permanently increased sensitivity of treated area to thermal stimuli are associated with this modality of treatment [19, 20]. Also radiotherapy cannot be repeated once dose is reached, and there is always a difficulty in obtaining a definitive margin. It is worth noting that the functional and cosmetic results were excellent in this series of patients, with no disfigurement and high level of patient satisfaction (Fig. 6A and B). It

would also be pertinent to note that postoperative complications were mostly minor and transient in the form of residual edema, thereby confirming the minimal morbidity of the procedure. Of importance is also the fact that this modality of treatment was imparted on a day care basis. Although we were unable to perform a detailed cost analysis due to the surgical nature of the study, but we do believe that there will be substantial cost savings as this technique eliminates hospital admissions and bed occupancy. Moreover it also abolishes the hidden costs to patient's attendants of time off from work and time away from home. Last but not the least, this modality of treatment does not compromise future treatment for recurrent, residual or second primary disease.

This modest experience is thus consistent with and corroborates reports from other groups that cite advantages of Nd:YAG laser. It is imperative to note that coagulative properties of Nd:YAG laser markedly exceeds that of CO₂ laser [12]. Also it is fiber delivered (CO₂ laser is delivered down an articulated arm by series of mirrors), this means that apparatus is much more robust and flexible. Moreover such a system enables the laser to be introduced in body cavities or closed anatomical spaces (unlike CO₂ laser) [12]. Review of literature even indicates the use of this laser in arthroscopic surgery of temporomandibular joint [21]. It is also associated with less scarring, as there is decreased production of fibroblasts with Nd:YAG laser [22]. A study in literature reports the reduced in vivo local recurrence with contact Nd:YAG laser scalpel [23]. In addition, the use of Nd:YAG scalpel is akin using knife, a feel that is usually absent in CO₂ laser.

Although this study delineates the importance of Nd:YAG laser in cases of carcinoma lip, there are caveats to our study design. All shortcomings of a retrospective study design are evident viz: non-randomized nature, incomplete data records, results not ascertained blindly and a lack of an appropriate surgery only control group. In addition critics may contend that the study has a selection bias and data on a long-term outcome is not available in all the patients. This certainly influences the final oncological result. Unfortunately due to the rural background, poor socio economic status and illiteracy of our patient profile this shortcoming of high drop out became inherent to the study design, something beyond our control in spite of our best efforts. Nevertheless the true value of this study in context of existing literature is the evaluation of Nd:YAG laser for treatment of carcinoma lip in an exclusive series of T₁N₀M₀ cases hitherto unreported. This study marries the realities of clinical practice with rigors of scientific investigations and thus may invite hypothesis for future prospective randomized trials.

Conclusion

As observed in this study, the treatment outcome in lip cancer with Nd:YAG laser is promising albeit in select cases of stage I only.

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