Prospective Evaluation of Surgical Outcome After Transoral CO₂ Laser Resection of Potentially Malignant and Early Oral Malignancy

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Abstract

A prospective observational study was done at the Regional Cancer Centre, Thiruvananthapuram, a tertiary referral center for cancer care in India with an aim to assess the surgical outcomes of CO₂ laser resection of oral lesions in terms of operative time, blood loss, hospital stay, postoperative pain, time to re-epithelization, pathological margins achieved and the postoperative scar. The excision was performed in 30 patients with a diagnosis of either potentially malignant lesions (leucoplakia, erythroplakia) or early cancers, i.e., carcinoma in situ or T1/T2 squamous cell carcinoma of the anterior oral cavity (tongue, buccal mucosa), adhering to standard oncological principles, and the resultant defect was left for secondary healing.

Keywords CO₂ laser · Excision · Premalignant lesion · Early oral malignancy

Introduction

Ever since its discovery in 1964 by Kumar Patel of Bell Lab, its use in head and neck cancer management has made tremendous progress as a diagnostic and therapeutic tool [1]. The major advantages cited in the literature concerning the use of CO₂ laser are minimal postoperative swelling and scarring, improved wound healing, and decreased postoperative pain and consequent lowering of postoperative use of analgesics [2, 3]. Laser excision has various other advantages like better morphological preservation, functional recovery like speech and swallowing, and less adjacent thermal (collateral) damage [3–5]. The present study will therefore provide an evidence-based data of the short- and long-term surgical outcomes of transoral CO₂ laser in potentially malignant lesions and early cancers of the oral cavity.

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Material and Method

A study of surgical outcomes of consecutive cases undergoing transoral CO₂ laser resection of potentially malignant lesions and T1/T2 early oral malignancy was carried out to assess intraoperative blood loss, hospital stay, postoperative pain, time to re-epithelization, pathological margins attained, postoperative scar and functional outcome, and 1-year locoregional recurrence rate. Inclusion criteria in the study were patients with ECOG score of 0/1, patients with potentially malignant lesions like leucoplakia (non-homogenous), erythroplakia, and carcinoma in situ and early malignant (T1/T2) squamous cell carcinoma of the anterior oral cavity (tongue, buccal mucosa). Exclusion criteria were thick infiltrative disease, presence of significant neck node, and pathological indications for further adjuvant treatment.

We assessed thickness of lesion clinically, i.e., lesions with significant surrounding induration were considered thick and excluded from study. With informed consent from all the patients, demographics and operative details were captured in a predesigned proforma.

Results

Thirty patients with biopsy-proven oral premalignant and malignant lesions were treated with the CO₂ laser excision under

Table 1 Demographic distribution and diagnosis

Sex	Male—19 (63.3%)	Female—11(36.6%)
Habit	Smoking—12 (40%)	Alcoholic & tobacco chewer—14 (60%)
Site	Tongue—27 (90%)	Buccal mucosa—3 (10%)
Preoperative diagnosis	Squamous cell carcinoma—16 (53.3%)	Leukoplakia—14% (46.6%)
Pathological diagnosis	Squamous cell carcinoma—23 (76%)	Hyperplastic hyperkeratotic epithelium—7 (24%)
Pathological stage	pT1—22 (95.6%)	pT2—1 (4.3%)

general anesthesia during a 2-year period at the Department of Surgical Oncology RCC, Thiruvananthapuram. Laser power output of 5 to 15 W on a pulsed or continuous mode was used for all the resections with adequate margins under frozen section control. Wounds were left for secondary healing. Operative time was measured in minutes from incision to the end of the procedure. Blood loss was estimated in milliliter with the weight of blood soaked gauze(s). Visual Analog Scale (VAS) was used to evaluate the intensity of postoperative pain. Each patient was told how to use the VAS; VAS score was taken at 24 h and then daily for the following 6 days. Finally, the patients were reviewed at 7 days after treatment. Paracetamol tablet 650 mg thrice a day for 4 days was given to all the patients. Extent of scar and presence of any functional impairment were recorded at the third and sixth months. All patients were followed up weekly for 1 month and then at three monthly intervals for a year, and the observations were entered in the proforma.

Postoperative functional outcome of speech was subjectively analyzed by using the Voice Handicap Index (VHI). Incidence of local or locoregional recurrence was documented

until 1 year after the procedure. All clinical recurrences had to be proven with biopsy.

Statistical Analysis

Results were presented as mean and standard deviation for continuous variables and were compared using Student's *t* test. Categorical variables were described by relative frequency and were compared by chi-square Table 1.

Result

Operative Time (min) The mean operative time was 36.4 min with standard deviation (SD) of 5.65. Maximum time was 45 min and minimum was 20 min Graph 1.

Blood Loss Average intraoperative blood loss was 14.23 ml with standard deviation of 3.67. Maximum intraoperative blood loss was 20 ml and minimum was 10 ml. Graph 2.

Graph 1 The operative time in min, i.e., time from the marking with the laser until the completion of procedure

Graph 2 The intensity of postoperative pain which was measured by using the Visual Analog Scale (VAS)

Graph 3 The time to re-epithelization in weeks

Postoperative Pain (VAS Score) Each patient was told how to use the VAS; VAS score was recorded at 24 h and then daily for the following 6 days. Finally, the patients were revised at 7 days after treatment. Paracetamol tablet 650 mg tds $\times$ first 4 days was given to all the patients. The mean VAS score on the first POD was 1.8 which decreased subsequently to 0.9, 0.53, 0.06, and 0.03 on POD2-7.

Hospital Stay The mean hospital stay in days was 2.3 days with SD of 0.84. The maximum hospital stay was 4 days and minimum was 1 day.

Postoperative Bleeding Two patients had significant postoperative bleeding and both required re-exploration. One patient had history of IHD and he was on ecosporin preoperatively and another patient was hypertensive Graph 3.

In this study, the mean time to re-epithelization was 3.86 weeks with SD of 0.62. The maximum time to re-epithelization was 6 weeks and minimum was 3 weeks. Majority of the patients attain complete re-epithelization within 3–4 weeks Table 2, Figs. 1 and 2.

The mean VHI score at 3 months was 15.63 with SD 5.89 and at 6 months, it was 9.8 with SD of 4.6. So, none of our patients had voice impairment.

At time of the completion of the study, one patient had nodal recurrence for which neck dissection was done. None of the patients developed local recurrence.

Discussion

Oral squamous cell carcinoma (OSCC) is one of the commonest cancer in the Indian population. Leukoplakia and erythroplakia are considered to be their precursors [6]

Table 2 The postoperative function outcome of speech which was measured with the help of the VHI score

Postoperative functional outcome of speech	
Duration	VHI score (mean)
3 months	15.63 (SD 5.89)
6 months	9.8 (SD 4.6)

and they have around 6 to 36% risk of progression to cancer [7]. To prevent progression, surgical excision is largely preferred in cases where the lesion is solitary and laser is very often the tool of choice for excision whenever available [8, 9]. Majority of OSCC are diagnosed in the sixth to eighth decades. Most patients in our study were in the age 30 to 70 years with a mean of 53.6 years. Males are generally considered more at risk of developing premalignant and malignant lesions in the oral cavity. Our study had a total of 30 patients. Nineteen (63.3%) were male and 11 (36.6%) were female.

Tobacco exposure represents the most significant risk factor for OSCC, with alcohol consumption being both synergistic and independent risk factor. In our study, 12 (40%) of patients were smokers, 18 (60%) were tobacco chewers/smokers and alcoholic in past. In our study, it was observed that 27 (90%) of the patients had primary in the tongue and 3 (10%) patients had primary in the buccal mucosa. Preoperatively, 16 (53.3%) were diagnosed as squamous cell carcinoma and 14 (46.6%) were diagnosed as leukoplakia. Postoperatively, 23 (76%) patients were diagnosed with squamous cell carcinoma and 7 (23%) were hyperplastic hyperkeratotic epithelium with various degrees of dysplasia. Seven (50%) patients which were preoperatively diagnosed as leukoplakia were diagnosed as SCC on the final postoperative histopathology report.

Out of 23 patients which were diagnosed as SCC carcinoma on the final postoperative histopathology, 22 (95.6%) were in its T1 stage and 1 (4.3%) was a T2 cancer. Mean operative time was 36.4 min with SD of 5.65. Maximum time was 45 min and minimum was 20 min. In one of the study, time for laser excision is found to be more than that in scalpel excision [10]. Laser has hemostatic effects. It induces

Fig. 1 Preoperative picture of lesion

Fig. 2 Picture taken after 3 weeks of surgery

contraction of collagen in the walls of the vessels. Hence, some of the studies have shown shorter operative time and less blood loss. In our study, mean intraoperative blood loss was 14.23 ml with SD of 3.67. Maximum intraoperative blood loss was 20 ml and minimum was 10 ml. Postoperative pain is less in laser surgery and this is evident by less dependence on analgesics, shorter hospital stay, and early return to work [2, 5]. Postoperative functional outcomes like swallowing and speech are better because of optimization of the wide excision attained compared to that of cold instruments and anatomically based resections [5]. After laser surgery, there is formation of a necrotic zone at the edge of the incision which acts as a scaffolding for re-epithelization. In most of studies, time to re-epithelization ranges between 3 and 6 weeks [11, 12]. Laser wounds show delay in inflammation. There is also delay in collagen production, re-epithelization, and tensile in early stage. In later stage, there is no difference in tensile strength [13].

Conclusion

CO₂ laser is beneficial in the management of premalignant and low-risk T1/T2 tumors of the oral cavity with the specific advantages of rapid re-epithelization and softer scar with minimal intraoperative blood loss, postoperative pain, and functional impairment and no compromise in oncological outcome.

Compliance with Ethical Standards

With informed consent from all the patients, demographics and operative details were captured in a predesigned proforma.

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