Transoral Laser Surgery for Early Glottic Cancers

Sultan A. Pradhan, FRCS, MS, FCPS; Prathamesh S. Pai, MS, DNB, DORL; Siddalingeshwar I. Neeli, MS; Anil K. D’Cruz, MS, DNB

**Objectives:** To demonstrate the oncologic safety of transoral endoscopic laser surgery in early glottic cancers.

**Patients:** The study included 107 patients with early glottic cancers. The disease was in situ in 21 (19.6%) and infiltrative in 86 (80.4%), of which 52 (48.6%) were stage T1a, 17 (15.9%) were T1b, 13 (12.1%) were T2, and 4 (3.7%) were TX lesions. One hundred three patients (96.3%) were treated primarily, whereas 4 patients (3.7%) were operated on after radiotherapy failure. Anatomically, 77 lesions (72.0%) involved the anterior or middle third of the vocal cord; 14 lesions (13.1%) involved a single cord and the anterior commissure; 4 “horseshoe” lesions (3.7%) involved both cords and the anterior commissure; 7 lesions (6.5%) involved the posterior third of the cord reaching the vocal process of the arytenoid; and 5 cases (4.7%) involved both cords separately.

**Results:** There were 17 (15.9%) local recurrences (10 among patients with single cord lesions, 5 among patients with cord and anterior commissure lesions, and 2 among patients with lesions involving both cords), and 1 regional recurrence. One hundred one patients (94.4%) were alive and disease free at a median of 40.7 months. Three patients (2.8%) were alive with disease. One patient (0.9%) died of other causes. Two patients (1.9%) died of a second primary cancer. The overall larynx preservation rate was 92.5%. Recurrence-free survival was 86.6% at 2 years, 84.1% at 5 years, and 78.1% at 10 years.

**Conclusion:** Transoral laser surgery is an oncologically safe, function-preserving modality for treatment of early glottic cancers.


IN THE TREATMENT of laryngeal cancer, equal emphasis is laid on maximizing cures and preserving laryngeal function. In early glottic cancers, radiation therapy (RT) and open partial laryngectomy (OPL) achieve these objectives with more or less comparable results; surgery is slightly superior in cure rate, but RT achieves better voice quality. The use of OPL also involves a temporary tracheotomy and hospitalization, both of which are drawbacks of this treatment modality.

Transoral endoscopic laryngeal laser surgery (TLS) obviates this disadvantage, since it is performed on an outpatient basis and tracheostomy is not required. Cure rates with TLS are reported to be comparable to those after RT or OPL. All of these factors make endoscopic laser resection a useful voice-conserving treatment modality for early glottic cancers. This study was undertaken to evaluate the effectiveness of TLS as a superior treatment of early glottic cancers.

**METHODS**

Between January 1, 1991, and January 31, 2002, 179 patients with glottic cancers were treated with the carbon dioxide laser at the Tata Memorial Hospital, Mumbai, India. Data from 107 patients with a minimum follow-up of 18 months were analyzed. The disease was in situ in 21 (19.6%) and infiltrative in 86 (80.4%), of which 52 (48.6%) were stage T1a, 17 (15.9%) were T1b, 13 (12.1%) were T2, and 4 (3.7%) were classified as TX lesions. All were clinically node negative. One hundred three patients (96.3%) were treated primarily, while 4 (3.7%) were operated on after failure of RT. All of the patients were treated on an outpatient basis, and none of them required tracheostomy after laser excision.

Anatomically, there were 77 lesions (72.0%) involving the anterior or middle third of the vocal cord; 14 lesions (13.1%) involving a single cord and the anterior commissure; 4 “horseshoe” lesions (3.7%) involving both cords and the anterior commissure; 7 lesions (6.5%) involving the posterior third of the cord reaching the vocal process of the arytenoid; and 5 cases (4.7%) involving both cords separately.

**RESULTS**

There were 18 recurrences: 17 local (15.9%), of which 15 were salvaged, and 1 regional (0.9%), which was salvaged. Five patients (4.7%) developed second primary cancers: 4 occurred on the opposite cord (1 was salvaged with repeat laser treatment, 1 with repeat laser and RT, 1 with total laryngectomy, while 1 patient refused salvage treatment and later died), and 1 patient developed esophageal cancer and died of it.

From the Head and Neck Services, Tata Memorial Hospital, Parel, Mumbai, India. The authors have no relevant financial interest in this article.
Recurrence-free survival in early glottic cancers (N=107).

<table>
<thead>
<tr>
<th>Result</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>Recurrence</td>
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<td></td>
<td></td>
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<tr>
<td>Local</td>
<td>15</td>
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<td>2</td>
</tr>
<tr>
<td>Regional</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Second primary cancer</td>
<td></td>
<td></td>
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<tr>
<td>Opposite cords</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Esophagus</td>
<td>1</td>
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<td>0</td>
</tr>
<tr>
<td>Current status</td>
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<td></td>
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<tr>
<td>Alive, disease free</td>
<td>101</td>
<td>94.4</td>
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</tr>
<tr>
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<td>3</td>
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<tr>
<td>Died of other cause</td>
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<td></td>
</tr>
<tr>
<td>Died of second primary cancer</td>
<td>2</td>
<td>1.9</td>
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</table>

The larynx preservation rate was 92.5%.

Of the 77 patients with single-cord lesions, 10 (13.0%) developed local recurrence. Among 14 patients with cord and anterior commissure lesions, 5 (35.7%) developed local recurrence. Of the 5 patients with lesions involving both cords, 2 (40.0%) developed local recurrence.

One hundred one patients (94.4%) were alive and disease free at a median follow-up of 40.7 months (range, 18-124 months). Three patients (2.8%) were alive with disease, 1 patient (0.9%) died of another cause, and 2 patients (1.9%) died of a second primary cancer. The overall larynx preservation rate was 92.5% (Table). The actuarial recurrence-free survival analysis by the Kaplan-Meier method showed a survival of 86.6% at 2 years, 84.1% at 5 years, and 78.1% at 10 years (Figure).

Early glottic disease encompasses lesions ranging from carcinoma in situ to T2 lesions with normal cord mobility. Traditionally, treatment for these lesions would be either RT or OPL, depending on various factors such as the type of tumor, location within the glottis, age and vocation of the patient, availability of technology and instrumentation, and the philosophy of the treating physician. The ideal treatment modality for early glottic cancers would be one that offers high cure rates and good voice quality, is single staged, does not require hospitalization, and most important for the patient, does not necessitate a tracheostomy—even a temporary one.

Radiotherapy offers good local control rates in Tis, T1a, and T1b lesions, ranging from 86% to 98%. In T2 lesions, most investigators have reported reduced control rates ranging from 68% to 73%. Thus, the promise of good control rate with organ preservation does not hold true with RT, as the laryngeal preservation rates in the series mentioned ranged from 95% to 98% in Tis to 91% to 98% for T1 lesions, but dropped to 76% in T2 lesions. Morbidity associated with the prolonged duration of the treatment, mucosal radiation reaction, and long-term side effects such as xerostomia are also deterrents for selecting RT as the treatment of choice. Also, anterior commissure involvement, restricted cord mobility, and large tumor volume respond poorly to RT. Voice quality after RT is nearly normal, and that is often the basis for preference of RT in early glottic cancers. However, some investigators have shown that the voice does not return to normal after RT and is perceptually different. Finally, the surgical salvage rate for postradiation failure is in the range of 50% to 80%.

Open partial laryngectomy has a proven role in local control of early glottic cancers, with local control rates in the range of 91% to 98% for T1 and 84% to 86% for T2 lesions. These are better than local control rates with RT, especially for lesions involving the anterior commissure and those with impaired cord mobility. After OPL, because of the manipulation of the laryngeal skeleton, there is postoperative pain and edema and a temporary tracheostomy is necessary. Both are deterrents to selecting this treatment modality. Voice quality after OPL is audible and coherent but is definitely inferior to postradiation voice quality. Salvage is possible after local recurrence in more than 70% of patients with total laryngectomy or RT.

With the advent of the laser beam coupled with the microscope, treatment of squamous cell carcinomas of the vocal cord has been revolutionized. The magnified view through the microscope and the precision of the laser beam allows the resection to be carried out with narrow margins, thus conserving useful paraglottic tissue including the vocalis muscle in carcinoma in situ. The resection is relatively bloodless and requires no hospitalization and no tracheostomy. The voice quality after TLS is definitely superior to that after OPL and, although inferior to that after RT, is nevertheless good.

**CONTROL RATES**

In our series, among the Tis cases, there were 3 local recurrences (14.3%). All were salvaged: 1 with OPL, 1 with total laryngectomy, and 1 with repeat laser.

Among the T1a cases, there were 5 local recurrences (9.6%), of which 1 was salvaged with OPL and 3 with total laryngectomy; 1 patient opted for RT for salvage and thereafter was lost to follow-up. In the T1b group, there were 6 local recurrences (35.3%), of which 3 were salvaged with repeat laser and 2 with total laryngectomy; 1 patient opted for RT for salvage and later stopped coming for follow-up. One regional recurrence was salvaged with neck dissection and postoperative RT. Thus, the local control rate in Tis, T1a, and T1b lesions was 84.5% with a larynx preser-
viable alternative. Thus, glottic lesions with anterior com-
missure tumors, Rebeiz et al34 described a combined
surgery for lesions of the anterior commissure. 
therefore, do not recommend the use of endoscopic la-
ynamo surgery for Tis tumors. 
described three recurrences were salvaged with total laryngec-
mistry and 1 with repeat laser, while one was lost to fol-
low-up after the patient opted for RT as salvage. 
In addition to the fact that the area of the anterior
commissure is not easily accessible endoscopically, an-
terior commissure lesions are often understaged; the in-
volvement of the thyroid cartilage is often missed or mis-
judged, with the result that a true T4 lesion may be treated as 
T2 with consequent poor results. Many workers, 
therefore, do not recommend the use of endoscopic la-
surgery for lesions of the anterior commissure. 
While cautioning against the use of TLS for anterior
commissure tumors, Rebeiz et al34 described a combined 
endoscopic and open technique called the "window par-
tial laryngectomy" for tumors at this site, which seems a 
visible alternative. Thus, glottic lesions with anterior com-
missure involvement merit careful clinical and radiologic 
evaluation before TLS is considered as a treatment option. 

CONCLUSIONS 
Transoral endoscopic laser surgery is an oncologically 
sound, voice-conserving treatment modality. It has the 
added advantage that it requires no hospitalization and 
no tracheostomy. Voice quality after laser resection is 
slightly inferior to that after RT, but definitely superior 
to that after a vertical partial laryngectomy or a laryngo-
fissure with cordectomy. Cure rates are comparable to 
those after RT or OPL. Caution should be exercised in 
resecting lesions of the anterior commissure. These should 
bbe subjected to endoscopic laser surgery only when the 
exposure is adequate and the tumor is not infiltrative. 

Accepted for publication October 18, 2002. 
Corresponding author and reprints: Sultan A. Pradhan, 
FRCS, MS, FCPs, Head and Neck Services, Tata Memorial 
Hospital, Dr Ernest Borges Marg, Parel, Mumbai 400012, 
India (e-mail: npradhan@vsnl.com).

REFERENCES
1. Sola B, Fernandez-Vega M, Martinez T, Sola E, Fernandez-Vega S, Ramírez C, 
The Gregorio Maranon Hospital experience with vertical partial laryngectomies. 
2. Thomas JV, Olsen KD, Neil HB III, DeSanto LW, Suman VJ. Early glottic carci-
noma treated with open laryngectomy procedures. Arch Otolaryngol Head Neck 
3. Johnson JT, Myers EN, Hao SP, Wagner RL. Outcome of open surgical therapy 
4. Ten-Van J, Lefebvre JL, Stern JC, Buisset E, Coche-Dequeant B, Vankemmel B. 
Comparison of surgery and radiotherapy in T1 and T2 glottic carcinomas. 
5. Lipp L, del Maso M, Cellai E, Olmi P. Early glottic cancer: surgery or radiation 
for Tis, T1, and T2 glottic carcinomas: cure rate and prognostic factors. Oto-
8. Pukander J, Karla J, Makite A, Hyyrykangas K, Virtaniemi J, Grenman R. En-
dooscopic laser surgery for laryngeal cancer. Eur Arch Otorhinolaryngol. 2001; 
258:236-239. 
9. Mendenhall WM, Amour RJ, Morris CG, Hinerman RW. T1-T2N0 squamous cell 
19:4029-4036. 
early glottic cancer: the Rabin Medical Center retrospective study on 207 pa-
15. Reddy SP, Mohideen N, Marra S, Marks JE. Effect of tumor bulk on local control 
and survival of patients with T1 glottic cancer. Radiother Oncol. 1998;47:161-166. 
prognostic significance of impaired vocal cord motility in patients with stage II 
17. Kaplan MJ, Johns ME, Clark DA, Cantrell RW. Glottic carcinoma: the roles of sur-
18. Burke LS, Green KM, McGuirt WT, Case D, Hoen HM, Raben M. Definitive ra-
ditherapy for early glottic carcinoma: prognostic factors and implications for 
20. Honocoeveer-Boltezar I, Zargi M. Voice quality after radiation therapy for 
ity of voice following radiation therapy for T1 glottic cancer. Radiother Oncol. 
1997;45:149-153. 
Laryngeal Cancer. Amsterdam, the Netherlands: Elsevier Science; 1994:54-64. 
23. McLaughlin MP, Parsons JT, Fein DA, et al. Salvage surgery after radiotherapy fail-
24. Rucci L, Gallo D, Fini-Storchi D. Glottic cancer involving anterior commissure: 
25. Lydiatt WM, Shah JP, Lydiatt KM. Conservation surgery for recurrent carci-
26. McGuirt WF, Blalock D, Koufman JA, Fehrs RS. Voice analysis of patients with en-
doscopically treated early laryngeal carcinoma. Ann Otol RhinoLaryngol. 1992;101: 
142-146. 
27. Rydell R, Schalén, Fox S, Ehrn A. Voice evaluation before and after laser excision 
30. Thumfart WF, Eckel HE, Sprinz GM. Analysis of recurrences after transoral laser 
31. Rueter HH, Werner JA. Endoscopic resections of glottic and supraglottic carci-
33. Zetteis SM. Infrapetiole exploration of the supraglottis for exposure of the ante-
34. Rebeiz EE, Wang Z, Amnio DJ, McGillinan JA, Shapshy SM. Preliminary clinical 
results of window partial laryngectomy, a combined endoscopic and open tech-

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