Functional outcomes of transoral laser surgery of supraglottic carcinoma

R. Cabanillas1, C. Ortega2, J. P. Rodrigo1, J. L. Llorente1, P. Ortega2, C. Suárez1


Abstract: Objectives: To analyse the functional outcome of patients with supraglottic carcinomas treated by transoral laser surgery. Methods: The clinical records of 55 patients who underwent transoral laser surgery were reviewed. Swallowing capacity, surgical complications, requirements for tracheotomies, percentage of decannulations, laryngeal paralysis, stenosis, aspiration associated pneumonia, time to remove the nasogastric tube and postsurgical stay in hospital were the studied variables. Results: 52% of the patients had a normal or within functional limits swallowing performance. 18% suffered aspiration pneumonia. 13% developed a laryngeal stenosis. 7% suffered of laryngeal palsy. 18 tracheostomies were performed, of them 10 could be reverted. The mean time to remove the nasogastric tube was 9 days. The mean hospital stay was 23 days. Conclusions: The main functional advantages of transoral laser surgery for supraglottic carcinoma, when compared with the conventional approach, are a lower incidence of temporary tracheotomies, a faster removal of the nasogastric feeding tube, and a lower incidence of pharyngocutaneous fistulas (0%).

Key words: Supraglottic carcinoma. Aspiration. Swallowing. Laser.

INTRODUCTION

Two methods of treatment are essentially considered when dealing with a supraglottic carcinoma: surgery or radiotherapy; either independently or combined1-3. If the option chosen includes surgery, it will be necessary to opt for either an open transcervical approach or a closed transoral one. Alonso4 was the first to describe a horizontal supraglottic laryngectomy in 1947. This partial technique became popular because it produced similar oncological results to a total laryngectomy, preserving the patient’s voice and incurring a lower morbidity rate2,5-7.

In 1992, Strong and Jako8 introduced the use of a CO2 laser for the endoscopic treatment of supraglottic carcinomas. The transoral approach for this type of tumor seems to contradict the classic conditioning factors of cancer surgery9 as large tumors cannot be extracted in one piece, requiring their fragmentation in order to be resected. However, the hemostatic capacity of the CO2 laser and the use of a microscope during the operation enable the safe fragmentation of the tumor and the viewing of the boundary between the tumor and the healthy adjacent tissue. If disease-free surgical margins can be obtained, the oncological results of transoral laser surgery seem to be comparable to those obtained with a conventional supraglottic laryngectomy6. In regard to elective neck treatment, the majority of authors agree on the need to perform node dissection at stages I and II of the illness, as the probability that hidden node metastasis exists is high enough for the benefits of dissection to outweigh the risks2,6,10-14.

Numerous studies have attributed advantages of a functional character to transoral surgery when compared with the transcervical approach, even when the cervical node dissection is done in a second operation. Among the advantages described, the need to carry out a lower number of tracheotomies, the lower incidence of aspiration pneumonia, a shorter stay in hospital, a lower frequency of pharyngocutaneous fistulas and a quicker return to oral swallowing have been found2,6,9,15-18.

In this paper we will analyze the functional results of supraglottic laryngectomy using CO2 laser, and in this way contribute to the discussion of its advantages and disadvantages.
FUNCTIONAL OUTCOMES OF TRANSORAL LASER SURGERY OF SUPRAGLOTTIC CARCINOMA

Table 1: Clinico-pathological characteristics of the patients included in our study

<table>
<thead>
<tr>
<th>T</th>
<th>T1</th>
<th>13 (24%)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>T2</td>
<td>21 (38%)</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>21 (38%)</td>
</tr>
<tr>
<td>N</td>
<td>N0</td>
<td>32 (62%)</td>
</tr>
<tr>
<td></td>
<td>N1</td>
<td>12 (22%)</td>
</tr>
<tr>
<td></td>
<td>N2</td>
<td>8 (14%)</td>
</tr>
<tr>
<td></td>
<td>N3</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>M</td>
<td>M0</td>
<td>54 (98%)</td>
</tr>
<tr>
<td></td>
<td>M1</td>
<td>1 (2%)</td>
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Stage

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>9 (16%)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>II</td>
<td>13 (24%)</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>25 (42%)</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>10 (18%)</td>
</tr>
</tbody>
</table>

MATERIAL AND METHODS

This retrospective study is based on 55 patients with supraglottic carcinomas who underwent transoral supraglottic laryngectomy surgery using CO₂ laser in one of two hospitals between 1992 and 2002. Only one patient had distant metastasis at the time of the diagnosis.

The patients were aged between 37 and 83 years, the average age was 60. The group was made up of 54 males and 1 female.

The disease staging was done using the 5th edition of the International Union Against Cancer’s TNM system. 13 patients (24%) had T1 classified tumors, 21 (38%) T2 and 21 (38%) T3. The clinical pathological characteristics of the patients included in our series are given in Table 1.

The transoral approach was prescribed for stage T1, T2 and T3 supraglottic tumors in which the tumors could be completely exposed during the diagnostic microsurgery carried out prior to the laryngectomy. A conventional transcervical supraglottic laryngectomy, or a total laryngectomy in the event that the vocal cords or the laryngeal cartilage were affected, was performed on the patients who did not meet this criteria. The transoral supraglottic laryngectomies using CO₂ laser were performed following Davis’s¹⁹ recommendations.

A nasogastric tube was placed in 48 out of the 55 patients (87%) during the same operation.

A bilateral cervical node dissection (functional or radical depending on the clinical and surgical findings) was performed on all the patients. The dissection was done 15 days after the supraglottic laryngectomy in all cases bar one, in which the dissection was done at the same time as the primary tumor resection. The dissection was delayed with the intention of reducing the risk of airway edema and therefore reducing the number of tracheotomies carried out.

Post-operative radiotherapy was administered to 17 of the 55 patients (31%). As a general rule it was administered to patients with stages pN2 or pN3.

The variables studied were: swallowing, surgical complications (abscesses, seromas, hematomas/hemorrhages, lymphorrhagia, cutaneous necrosis, surgical wound dehiscence, subcutaneous emphysema), frequency of tracheotomy, percentage of decannulations, paralysis and laryngeal stenosis, incidence of pharyngocutaneous fistulas, aspiration pneumonia, period of time with nasogastric tube and post-surgical hospital stay.

Swallowing was assessed four weeks after the operation. This time period was chosen in order to avoid the effects that post-operative radiotherapy could have on swallowing in the group of patients it was necessary to administer it to. To evaluate swallowing, we used an adaptation of the Swallowing Performance Status Scale²⁰ (SPSS, Table 2). The data to complete the evaluation was obtained from medical histories, from the evaluation of the patients’ opinions, clinical observations and physical examinations.

The average patient follow-up period lasted 36 months (with a range of 6 to 109 months). The average follow-up time of patients with stage T1 was 53 months; patients with stage T2, 36 months; and patients with stage T3, 26 months.

The statistical analysis of the data was carried out using version 11.0 of the SPSS program for Windows. To compare the age differences of the patients that suffered aspiration pneumonia and those that did not, we used Student’s t test for independent samples. To

Table 2: Adaptation of the Swallowing Performance Status Scale for the patients included in our study

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>N</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Normal</td>
<td>13 (24%)</td>
</tr>
<tr>
<td>2</td>
<td>Within functional limits. Capable of ingesting their usual food without modifications but swallowing performance worsened following surgery</td>
<td>15 (27%)</td>
</tr>
<tr>
<td>3</td>
<td>Mild deterioration: Requires a modified diet or precautions have to be taken with the normal diet to minimize the risk of aspiration</td>
<td>15 (27%)</td>
</tr>
<tr>
<td>4</td>
<td>Mild-moderate deterioration: Requires a modified diet as well as having to take precautions to minimize the risk of aspiration</td>
<td>9 (16%)</td>
</tr>
<tr>
<td>5</td>
<td>Moderate deterioration: Despite a modified diet and swallowing precautions, has aspiration symptoms</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>6</td>
<td>Moderate-severe deterioration: Requires supplementary tube/enteral feeding.</td>
<td>7 (13%)</td>
</tr>
<tr>
<td>7</td>
<td>Severe deterioration: Cannot ingest anything orally.</td>
<td>2 (4%)</td>
</tr>
</tbody>
</table>


correlate the incidence of cases of aspiration pneumonia with stage T and with the scores obtained in the swallowing scale, we used the statistical chi-squared test. Spearman’s correlation coefficient was used to correlate T stage and age with the score obtained in the swallowing scale.

RESULTS

A total of 13 patients (24%) suffered some type of local complication, the majority of which were related to the dissection: 3 patients had sero-hematic collections; one patient suffered a lymphorrhagia and another suffered surgical wound dehiscence. Three patients suffered post-surgical hemorrhages which required an exploratory cervicotomy. The complications relating to the treatment of the primary tumor were 3 subcutaneous emphysemas (5.5%) and post-surgical bleeding from the artery branches of the superior part of the larynx, which made re-intervention necessary.

Four patients suffered laryngeal paralysis, (7%), and seven, (13%), stenosis. We have not been able to find any type of statistically significant association between the incidence of these complications and the administration of post-operative radiotherapy, (p=0.580 in the case of paralysis and p=0.185 in the cases of stenosis).

The nasogastric tube was left in for an average of 9.3 days. Nine patients still had the nasogastric tube inserted when the swallowing evaluation was carried out (4 weeks after surgery). In four of these patients enteral feeding could be discontinued. The five remaining patients needed additional procedures to avoid aspiration pneumonia episodes (3 total laryngectomies, 1 laryngeal exclusion operation and 1 gastrostomy).

The scores obtained in the SPSS scale are given in Table 2. The median score was 2 (swallowing within functional limits).

Among the factors that could influence swallowing, we have found a statistically very significant association between the SPSS scale score and the T stage (Spearman’s correlation coefficient of 0.545 and P <0.000). Thus, those patients that had more advanced T stages turned out to be those that suffered more pronounced swallowing difficulties following surgery. We did not find a statistically significant association between the SPSS score and the age of the patients (p=0.747).

The frequency of aspiration pneumonia cases, clinically and radiologically diagnosed, was 18% (10 patients). As opposed to swallowing, we did not find a statistically significant association between the incidence of aspiration pneumonia and the T stage (p=0.699) (Table 3). The average age of those patients that suffered aspiration pneumonia was 67, while that of the patients who did not have this complication was 59, a difference which turned out to be statistically significant (p= 0.030). The average age of the patients that suffered pneumonia and of those that did not are given in Table 3 according to the T stage. We have also found a statistically significant association between the SPSS score and the incidence of aspiration pneumonia (p=0.015).

Programmed tracheotomies were performed on 18 patients (33%), in 17 during the laryngectomy and in one patient as a consequence of a post-operative bleeding. Of these 18, we were able to decannulate ten, thus leaving 15% of the patients with a permanent tracheotomy. Of these eight patients, four could not be decannulated on account of difficulty in breathing which for their daily activities meant post-surgical stenosis; the other four were patients whose swallowing difficulties made either a total laryngectomy (3 patients), or laryngeal exclusion surgery (1 patient) necessary.

Finally, the average hospital stay, including the dissection carried out in a second operation, lasted 23 days.

DISCUSSION

In those supraglottic tumors in which it is possible to obtain adequate exposure by means of a direct laryngoscopy and in which it therefore proves technically feasible to obtain surgical margins free of disease, the oncological results obtained from a transoral supraglottic laryngectomy with CO2 laser are comparable to those obtained with a conventional transcervical supraglottic laryngectomy and, by extension, comparable to those of a total laryngectomy6-7,9.

Previous papers have attributed advantages of a functional character to transoral surgery in regard to the transcervical approach. The following advantages have been found among those described: the need to carry out a lower number of tracheotomies, the lower incidence of aspiration pneumonia, a shorter hospital stay, a lower frequency of pharyngocutaneous fistulas and the quickest return to normal oral swallowing2,6-9,15-19.
One of the main complications of the transoral supraglottic laryngectomy is difficulty in swallowing, more concretely, aspiration problems. The extension of the resection must be a fundamental factor when conditioning the degree of aspiration. In our series, the majority of patients, (52%) (Table 2), had swallowing which was classifiable as normal (1 point) or within functional limits (2 points); the group average being 2. The most important factor when predicting the swallowing capacity turned out to be the T stage; the patients with more advanced-stage tumors were those with the worst scores in the SPSS scale. As occurs with transcervical surgery, partial resections of the epiglottis rarely present aspiration problems, while other tumors of great dimensions, that oblige the extraction of the arytenoid cartilage or part of the lingual base, will very likely suffer dysphagia and aspiration phenomena following surgery.

Ten patients suffered aspiration pneumonia (18%), this frequency being similar to that described in previous series for the transcervical procedure (4.5-17%)6,14,18,21. Age proved to be a determining factor in the incidence of aspiration pneumonia (p=0.030), while the T stage did not appear to influence the onset of this complication (p=0.699) (Table 3). This finding could be surprising if we take into account that the incidence of aspiration pneumonia is indeed found to be related to the score obtained in the SPSS scale (p=0.015), because of which, it would be logical to think that the T stage should also be linked to this complication, however, it is not. These results can be explained taking into account that, independently of the stage, a high percentage (40-70%)14 of the patients that underwent a supraglottic laryngectomy had to tolerate, at least in the first few days after the operation, a certain degree of aspiration. The older patients were more vulnerable to pneumonia, having the same degree of aspiration as younger patients with better lung function parameters and possessing a more efficient immune system.

Additional surgical procedures were necessary for 9% of the patients, either to avoid the frequent episodes of bronco-aspiration (total laryngectomy or laryngeal exclusion surgery) or to be able to be fed by means of a gastrostomy. This frequency is similar to that described in previous papers for open surgery (10-13%)14,22. The average period of time before the nasogastric tube was removed was 9.3 days. Thus, the time the patients included in our study spent with the nasogastric tube inserted is less than the reference value for those that underwent a transcervical procedure (19-20 days)21,23. The fact that the tissues preserved during the endoscopic procedure conserve their innervation and that the integrity of the prelaryngeal muscle is maintained can justify the quicker swallowing recuperation observed in our patients. However, the percentage of patients that remain with the nasogastric tube in place for more than 35 days is greater in our series (13%) than in that of Herranz-González et al, in which only 7% of the patients operated on by means of the conventional technique spent more than 35 days with the nasogastric tube.

A programmed tracheotomy was considered necessary for 18 patients (33%). This is an evident advantage in regard to the conventional supraglottic laryngectomy, where the edema generated in the airway during the procedure necessitates the systematic practice of tracheotomies. We were able to decannulate ten patients, the percentage of permanent tracheotomies therefore being 15%, a similar percentage to that described for conventional surgery (7%-25%)14,21,24. The functionality of the remaining larynx in the 51 patients in which it could be preserved, (a total laryngectomy was performed on 3 patients and a laryngeal exclusion in another because of aspiration problems), proved to be good. Four patients had varying degrees of dysphonia because of laryngeal paralysis (7%) and seven (13%) dyspnea on moderate or great exertion because of stenosis. These percentages are similar to those found in the patients that underwent conventional supraglottic laryngectomies in which the percentage of stenosis amounted to 5 to 23%14,21. We have not found a statistically significant relationship between the administration of post-operative radiotherapy and the incidence of laryngeal stenosis.

The average hospital stay including the dissections carried out, in all except one of the cases, in a second operation, lasted 23 days. This number of days in hospital is similar to that indicated in previous papers for the transcervical procedure (22)21,23. So the need for 2 operations, with a similar duration of surgical stay to that of open surgery implies a disadvantage of laser surgery in regard to the conventional procedure. 24% of patients operated on had some type of post-operative complication of a local character. The majority of the complications were related to the dissections (seromas, hematomas, lymphorrhagia, hemorrrhages). The complications secondary to the treatment of the primary tumor were few, being limited to post-surgical bleeding and to the appearance of subcutaneous emphysema in three patients. The low incidence of pharyngocutaneous fistulas is considered to be one of the advantages that the endoscopic procedure has in regard to conventional surgery. The fistulas had a frequency of between 2% and 12% in open surgery14,21,24.

None of the patients included in our study presented this complication.

CONCLUSIONS

The advantages found in our study of the transoral supraglottic laryngectomy by means of CO₂ laser
compared to the conventional supraglottic laryngectomy are based on the need to carry out a lower number of temporary tracheotomies, a shorter period of time with the nasogastric tube and with a lower incidence of pharyngocutaneous fistulas.

References