SUPRACRICOID LARYNGECTOMY WITH CRICOHYOIDOEPIGLOTTOTHEXY FOR ADVANCED GLOTTIC CANCER

Roberto A. Lima, MD, Emilson Q. Freitas, MD, Fernando L. Dias, MD, Mauro M. Barbosa, MD, Jacob Kligerman, MD, Jose R. Soares, MD, Izabella C. Santos, MD, Ricardo M. Rocha, MD, Claudio R. Cernea, MD

Head and Neck Surgery Service, Brazilian National Cancer Institute/INCA, Avenida Armando Lombardi, 1000 Bloco 2/107, Barra, 22640-000, Rio de Janeiro, RJ, Brazil. E-mail: rlimamd@globo.com

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Abstract: Background. Supracricoid laryngectomy with cricothyroidoepiglottopexy (CHEP) is a conservative surgical procedure indicated in selected cases of advanced glottic carcinoma.

Methods. This study is a review of our experience with 43 patients with T3/T4 glottic squamous cell carcinoma who underwent CHEP in our institution. All but two patients underwent selective neck dissections. All patients were staged on the basis of the 2002 TNM classification. Rates of recurrence and death were estimated by the Kaplan–Meier method.

Results. The 5-year disease-specific survival and 5-year relapse-free survival rates were 78% and 83%, respectively. Neck metastases were found in three patients. Cartilage invasion occurred in 11 cases. The average length of hospital stay was 5.7 days. The mean time of enteral feeding tube was 33.8 days, and the mean time for tracheotomy was 29.6 days. Overall, normal swallowing was achieved in 74.4% of patients. Eleven patients had mild and major complications. Laryngeal stenosis emerged as the most frequent major complication. Three patients (6.9%) had local recurrences. Two patients (4.6%) had neck metastases.

Conclusions. On the basis of this study, over a 7-year period with 43 patients with advanced glottic cancer, a successful oncologic outcome is confirmed.

Keywords: supracricoid laryngectomy; laryngeal cancer; CHEP

The conventional surgical treatment for advanced squamous cell carcinoma of the larynx consists of total laryngectomy or total laryngectomy and postoperative radiotherapy.1–3 Because a laryngectomy results in substantial loss of function and a high degree of morbidity, organ preservation protocols with chemoradiation have been proposed to maintain laryngeal functional.4,5

Other surgical treatment options are near-total laryngectomy and supracricoid laryngectomy, which have been offered to patients with limited T3/T4 laryngeal cancer.6–9

Supracricoid laryngectomy with cricothyroidoepiglottopexy (CHEP) has been used to treat glottic cancer with impaired vocal cords (T2) and selected cases of fixed vocal cords (T3).10–12 However, few articles have been published in the international literature presenting a large series of T3/T4 glottic cancer treated by CHEP. Our objective was to analyze the functional and oncologic results in 43 selected cases of T3/T4 glottic cancer.
treated with CHEP with or without postoperative radiotherapy.

**MATERIALS AND METHODS**

From 1995 to 2003, our department performed 110 supracricoid laryngectomies, 107 reconstructed with CHEP and three with cricohyoidopexy (CHP). Fifty-three patients with T3/T4 tumors underwent to CHEP. Ten patients were excluded from this study because of a limited follow-up period (<12 months). The mean time of follow-up was 45 months (range, 12–116 months).

A retrospective analysis of 43 patients with advanced glottic squamous cell carcinoma was carried out. Forty-one patients with a fixed vocal cord but mobile arytenoid were classified as T3N0M0. One patient had thyroid cartilage invasion on the CT scan and was classified as T4aN0M0. Radiotherapy was unsuccessful in one patient, and the patient's disease was classified as rT3N0M0. The disease in all patients was reclassified according to the 2002 Union Internationale Contre le Cancer (UICC) TNM classification.13

The mean age was 64 years old (range, 46–86 years). Forty-one patients were men, and two were women. Forty-two patients had glottic lesions, and one patient had a glottic/subglottic lesion.

Three patients had undergone previous treatment; one had radiotherapy and two had endoscopic resection. The two patients who had endoscopic resection showed tumor in the surgical margins. Both had definitive surgery within 30 days.

Forty-one patients had a bilateral selective lateral neck dissection, and two patients had a unilateral selective lateral neck dissection.

Fourteen patients (32.6%) had postoperative radiotherapy, mainly in cases of thyroid cartilage invasion and neck metastatic lymph nodes (Table 1).

The functional results were analyzed focusing on the extension of the resection and the decannulation rate.

The chi-square test was used to compare two groups of patients according to the number of resected arytenoids, the occurrence of stenosis, and successful decannulation.

Rates of local and neck recurrences (relapse-free survival), death from cancer (disease-specific survival), and actuarial local control were estimated by the Kaplan–Meier14 method. A patient's death caused by secondary tumors or distant metastasis was also included in the disease-specific survival.

The statistical analysis was performed using the software EpiInfo 2002.

**RESULTS**

The 5-year actuarial disease-specific survival and 5-year actuarial relapse-free survival rates were 78% and 83%, respectively. The causes of death were second primary cancer, neck recurrence, local recurrence, and distant metastasis (Table 2). The 5-year actuarial local control was 85%.

One patient with neck lymph node recurrence was salvaged with a radical neck dissection, and two patients with local recurrences were salvaged with completion laryngectomy.

Postoperative histopathologic examination showed three (7%) patients with neck metastasis, 11 cases of cartilage invasion, three cases of perineural invasion, and two cases of vascular invasion.

One (9.1%) patient with cartilage invasion died from the disease, and four (12.5%) without cartilage invasion died from the disease. The occurrence of cartilage invasion did not influence the prognosis ($p > .05$).

Eight patients had the arytenoid on the tumor side resected; one (12.5%) had local recurrence. Thirty-five patients kept the two arytenoids, and two (5.7%) had local recurrences.

Fifteen patients had some degree of comorbidity. Eight patients had hypertensive vascular disease, four patients had diabetes, two patients had chronic airway obstruction, and one patient had previously treated heart disease. None of these comorbidities influenced the occurrence of complications.

<table>
<thead>
<tr>
<th>Pathologic classification</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyroid cartilage invasion</td>
<td>8</td>
</tr>
<tr>
<td>Neck metastasis</td>
<td>2</td>
</tr>
<tr>
<td>Thyroid cartilage invasion + neck metastasis</td>
<td>1</td>
</tr>
<tr>
<td>Thyroid cartilage invasion + perineural invasion</td>
<td>1</td>
</tr>
<tr>
<td>Thyroid cartilage invasion + vascular invasion</td>
<td>1</td>
</tr>
<tr>
<td>Close margins</td>
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</tbody>
</table>

**Table 2. Indications of postoperative radiotherapy.**

<table>
<thead>
<tr>
<th>Pathologic classification</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyroid cartilage invasion</td>
<td>8</td>
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<td>Neck metastasis</td>
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<td>Thyroid cartilage invasion + perineural invasion</td>
<td>1</td>
</tr>
<tr>
<td>Thyroid cartilage invasion + vascular invasion</td>
<td>1</td>
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<tr>
<td>Close margins</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2. Causes of death.**

<table>
<thead>
<tr>
<th>Follow-up</th>
<th>No. patients (%)</th>
<th>Salvaged</th>
<th>DOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck LN recurrence</td>
<td>2 (4.7)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Local recurrence</td>
<td>3 (7)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Distant metastasis</td>
<td>2 (4.7)</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>Esophageal second tumor</td>
<td>2 (4.7)</td>
<td>None</td>
<td>2</td>
</tr>
<tr>
<td>Tongue second tumor</td>
<td>1 (2.3)</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Prostate second tumor</td>
<td>2 (4.7)</td>
<td>2</td>
<td>—</td>
</tr>
</tbody>
</table>

Abbreviations: DOD, died of disease; LN, lymph node.
No deaths occurred in the early postoperative period. The total amount of postoperative complications was 25.6% (Table 3).

Two patients needed completion laryngectomy to treat aspiration (one had rupture of pexy). One patient with laryngeal stenosis was successfully decannulated after laser treatment; the remaining three patients needed a tracheotomy to breathe. The overall successful decannulation rate was 86%. The overall laryngeal preservation rate was 83.7%.

The mean time of enteral feeding was 34 days (range, 9–140 days), and the mean time of tracheotomy was 30 days (range, 5–90 days). The average length of hospital stay was 6 days.

The extension of the resection, including resection of one arytenoid, influenced the occurrence of laryngeal stenosis and successful decannulation (Table 4).

### Table 3. Postoperative complications.

<table>
<thead>
<tr>
<th>Complications</th>
<th>No. patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal stenosis</td>
<td>4 (9.3)</td>
</tr>
<tr>
<td>Important aspiration</td>
<td>1 (2.3)</td>
</tr>
<tr>
<td>Rupture of pexy + aspiration</td>
<td>1 (2.3)</td>
</tr>
<tr>
<td>Pharyngeal fistula</td>
<td>2 (4.7)</td>
</tr>
<tr>
<td>Wound infection</td>
<td>1 (2.3)</td>
</tr>
<tr>
<td>Postoperative bleeding</td>
<td>2 (4.7)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The objective of preservation surgery for advanced glottic tumors is to achieve the same local control as in a total laryngectomy.

A supracricoid laryngectomy with CHEP for the treatment of glottic carcinoma was first referenced in English-language literature in 1990. Thirty-six cases of CHEP were reported, mainly for T1–T2 tumors; glottic tumors with fixed vocal cords were excluded from this study.\(^{15}\)

In 1991 Piquet and Chevalier\(^ {16}\) published a study of 104 patients with glottic cancer treated with CHEP, 77 patients with T2 tumors, and 15 patients with T3 tumors.

After these two publications, this technique gained international acceptance.

In our department, most patients come to the hospital for the first time with advanced laryngeal cancers. This has influenced our team in extending the CHEP indications for patients with T3 glottic cancer.

The 5-year survival rate for all stages reported in the literature is 75% to 95%.\(^ {11,15-17}\)

Lefebvre and Chevalier\(^ {11}\) reported local recurrences in 4.8% and a 5-year overall survival of 76.8%; the most common cause of death from cancer was metachronous cancer. Chevalier et al\(^ {18}\) reported 5-year actuarial local control and 5-year cause-specific survival rates for patients with a fixed vocal cord of 95.4% and 94.1%, respectively. Piquet and Chevalier\(^ {16}\) in 1991 reported an 80% 5-year overall survival for patients with T3 disease.

In a recent publication, Dufour et al\(^ {9}\) reported a 5-year actuarial local control of 91.4% for patients with endolaryngeal glottic and supraglottic T3 cancer. Eight-one patients underwent CHEP, and 37 patients had CHP. In this publication, 100 patients had preoperative induction chemotherapy with cisplatin and fluorouracil.

In our series, the 5-year actuarial local control rate was 85%, similar to Piquet and Chevalier\(^ {16}\) but shorter than other publications.\(^ {11,18}\) The high rate of local control reported by some authors could be explained by the high rate of arytenoid resection on the tumor side, 80% to 85.6%.\(^ {9,18}\)

Reported anatomopathologic studies\(^ {19,20}\) showed that the fixation of the vocal cord in glottic carcinoma resulted from paraglottic space invasion with extensive invasion of the thyroarytenoid muscle. Hirano\(^ {21}\) reported that fixation of the vocal cord resulted from extensive invasion of the thyroarytenoid muscle.

In our group of patients, only eight patients (18.6%) had the arytenoid on the tumor side resected; this might explain our lower rate of 5-year actuarial local control. However, 62.5% had postoperative radiotherapy, and this might influence the results.

The survival rates reported in T3 glottic tumor series treated by surgery ranges from 54% to 80%.\(^ {3,22,23}\) In our study, the 5-year disease-free survival rate was 83% because of the limited vocal

### Table 4. Influence of resection of one arytenoid on stenosis and decannulation rate.

<table>
<thead>
<tr>
<th>Extension of resection</th>
<th>Laryngeal stenosis</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>One arytenoid resected</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>3 (37.5%)</td>
<td>5 (62.5%)</td>
</tr>
<tr>
<td>No</td>
<td>1 (2.9%)</td>
<td>34 (97.1%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complication</th>
<th>Successful decannulation</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal stenosis</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>1 (25%)</td>
<td>3 (75%)</td>
</tr>
<tr>
<td>No</td>
<td>36 (92.3%)</td>
<td>3 (7.7%)</td>
</tr>
</tbody>
</table>

*Fisher exact test.
cord tumor preserving the arytenoid mobility. Actually, the 2002 UICC/American Joint Committee on Cancer classification includes the invasion of the paraglottic space and erosion of the thyroid cartilage in a group of T3 glottic tumors. However, the differences in survival regarding T3 glottic tumors with vocal cord fixation and mobile arytenoid versus T3 glottic tumors with vocal cord and arytenoid fixation were not considered; this can explain the different survival reported.

The larynx preservation protocols successfully preserved the larynx in 50% to 66%, regarding the extent and site of the disease.

The VA Study Group4 preserved the larynx in 101 of 166 patients (66%); 64% retained a functioning larynx. Another article5 reported 44% successful larynx preservation in 25 patients with stage III and IV laryngeal cancer.

Lefebvre,11 in a study with 207 patients who underwent to CHEP, preserved the larynx in 200 patients. Ten (4.8%) had local recurrences; three were salvaged with a completion laryngectomy, and seven were not salvaged. In the same study, 17 patients had stenosis, and seven required a permanent tracheotomy. Although only 16 patients had T3 glottic tumors, the overall larynx preservation rates were 96.6%, 91.8% with a full, functioning larynx.

Endoscopic laser resection for T3 laryngeal cancer has been reported in the international literature as a laryngeal preservation option. Motta,24 in a study of 516 patients with glottic tumors treated by endoscopic laser resection, reported only 7.1% with T3 carcinoma. Other published series25,26 with more than 100 patients did not include T3 glottic tumors in the group of glottic tumors treated by endoscopic laser resection.

Thirty-eight patients in our series retained their larynx over a 5-year survival period. Our successful overall laryngeal preservation rate was 83.7%.

The differences in survival of patients with laryngeal cartilage invasion and exolaryngeal extension have been reported.27,28 The occurrence of thyroid cartilage erosion or invasion by the tumor without reaching the exolaryngeal tissues has not been correlated to the prognosis.

Our study showed similar results: pathologic cartilage invasion was detected in a surgical specimen of 11 patients, and this did not influence the survival rates.

The occurrence of a second primary tumor in patients with treated laryngeal cancer is relatively high; publications reported an incidence of 15% to 25%.23,29 Lefebvre11 found metachronous cancer as the most frequent type of failure and the second cause of death in 207 glottic carcinomas treated by CHEP. Laccourreye30 found 23.9% of metachronous second tumors in patients with glottic cancer treated by partial laryngectomy. This occurrence showed an adverse influence on the 10-year actuarial survival.

In our study of 43 patients who had to CHEP, second head and neck primary tumors occurred in three patients, and the main cause of death was a second primary tumor; this has been confirmed in other studies.11,16,31

One controversy regarding the treatment of glottic tumors is the elective neck dissection associated with CHEP because of the low rate of neck metastasis in this group of patients, 9%.18

Unlike other studies,12 we performed elective neck dissections in all of our patients. The incidence of occult neck metastasis was 7%, and the incidence neck recurrence was 4.6%. Other publications23,32 showed a 10% incidence of occult neck metastasis in glottic carcinoma. In these publications, the overall metastatic rate for glottic carcinoma was 22.2%, with extracapsular spread in 12 patients (37.5%). Another option, instead of elective neck dissection associated with CHEP for T3 tumors, is the watchful-waiting attitude; nevertheless, the rates of salvage neck dissection are as low as 11% to 56%.31,35 Foote22 reported a 29% incidence of delayed neck metastasis in 28 patients with T3 glottic tumor who did not undergo an elective neck dissection.

Successful decannulation with CHEP ranges from 93% to 98%.12,34,35

Thirty-seven patients (86%) in our study were successfully decannulated. The incidence of unsuccessful decannulation of our patients was associated with the incidence of laryngeal stenosis and a resected arytenoid. We believe that in T3 glottic tumors the complete resection of paraglottic space and the extension of mucosa resection, including surgical limits in the subglottis, lead the surgeon to try a correction of the mucosa gap, increasing the rate of laryngeal stenosis. Naudo10 found a relationship between arytenoid cartilage disarticulation and time to decannulation, but laryngeal stenosis occurred in only one patient.

In our study, only two patients had slight chronic obstructive pulmonary disease; one needed a completion laryngectomy because of severe aspiration, and the other needed 90 days with a tracheotomy. Because of the unequal mean time to decannulation reported, from 9 days to 91 days,10,17,34,35 it is difficult to establish the influence of variables.
like age or comorbidities on the time with a tracheotomy.

Naudo\textsuperscript{10} reported 9 days mean time to decannulation and found a relation between increased time with tracheotomy and advanced age and postoperative arytenoid edema.

Bron et al\textsuperscript{17} reported 27 days mean time to decannulation; 62 patients had one arytenoid cartilage resected, and the mean time with tracheotomy was 29 days. Nine patients had no arytenoid resected, with a mean time to decannulation of 36 days.

In our group of patients, the mean time to decannulation was 30 days, and the resection of one arytenoid was related to the occurrence of stenosis and unsuccessful decannulation.

The shorter hospital stay of our patients could explain our longer time to decannulation. The patients go home with a tracheotomy and come back to the hospital; we also evaluated carefully the decannulation risks in our outpatients.

Surgical complications after supracricoid laryngectomy are rated from 17.5\% to 40.5\%.\textsuperscript{10,17} Our study showed 25.6\% postoperative complications, and laryngeal stenosis emerged as the most common complication.

Our data suggest that supracricoid laryngectomy with CHEP is a safe surgical option to treat limited T3 glottic cancer. The incidence of complications and the extent of surgical resection do not compromise the functionality of this technique, even in selected cases of advanced glottic cancer.

REFERENCES


