RESECTION OF SELECTED INVASIVE SQUAMOUS CELL CARCINOMA OF THE PYRIFORM SINUS BY MEANS OF THE LATERAL PHARYNGOTOMY APPROACH: THE PARTIAL LATERAL PHARYNGECTOMY

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Abstract: Background. Although the lateral pharyngotomy is a well-known surgical procedure, to our knowledge, no published reports have described the results achieved with a lateral pharyngectomy approach in patients with isolated and previously untreated selected invasive squamous cell carcinoma of the lateral wall of the pyriform sinus.

Methods. The medical files and operative charts of 30 patients with an isolated, and previously untreated, squamous cell carcinoma of the pyriform sinus, treated for cure by lateral partial pharyngectomy and primary closure, as well as postoperative radiotherapy (n = 22), and preoperative chemotherapy (n = 8), were retrospectively studied. Sixteen tumors were classified as T1 and 14 as T2. All patients but one were followed until death.

Results. Three patients (9%) died in the immediate postoperative period (two from medical complications and one from a surgery-related complication). Overall, 29 patients died, resulting in a 77.7%, 40%, 23.3%, and 15% 1-, 3-, 5- and 10-year Kaplan–Meier actuarial survival estimate, respectively. Only one patient had a serious postoperative complication develop. All patients were decannulated. No patients required a gastrostomy and/or completion total laryngectomy for functional reasons. Local recurrence occurred in four patients (13%). The 3- and 5-year Kaplan–Meier actuarial local control estimates were 88.5% and 79.6%, respectively. The use of a platin-based induction chemotherapy (p = .05) regimen was the only variable that was significantly statistically related to local recurrence. Overall, a 93.3% laryngeal preservation rate was achieved.

Conclusion. Partial pharyngectomy by means of the lateral pharyngotomy combined with postoperative radiation therapy is an efficient and function-sparing approach to control selected invasive squamous cell carcinomas of the lateral wall of the pyriform sinus. © 2006 Wiley Periodicals, Inc. Head Neck 28: 705–711, 2006

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From a strictly semantic point of view, the lateral pharyngotomy is a lateral section of the pharynx. Recently, it is best known as an effective approach to resect selected malignant tumors of the oro-
However, it can also serve as a viable approach to tumors of hypopharynx and larynx.

Since the 1950s, only a handful of case reports have been devoted to the use of the lateral pharyngotomy to resect selected malignant tumors originating from the posterior pharyngeal wall of the hypopharynx and the posterior lateral wall of the pyriform sinus. To our knowledge, however, the use of this conservative surgical approach in a large series of patients undergoing lateral pharyngotomy for selected squamous cell carcinoma of the lateral wall of the pyriform sinus, with long-term follow-up, has not yet been presented.

This lack of data together with the use of the lateral pharyngotomy approach at our institution to resect selected invasive squamous cell carcinoma of the lateral wall of the pyriform sinus was the initial impetus for this retrospective study. More specifically, our study focuses on local recurrence searching for potential variables statistically related to local recurrence and analyzing the consequences of this oncologic event in terms of salvage treatment, laryngeal preservation, nodal recurrence, distant metastases, and death.

**PATIENTS AND METHODS**

The medical files of 32 patients with selected isolated, and previously untreated, moderately to well-differentiated invasive squamous cell carcinoma of the pyriform sinus, consecutively resected via a lateral pharyngotomy approach and primary closure for cure from 1965 to 2000 at a single institution, were retrospectively reviewed. Two patients with incomplete medical information were excluded. Details of comorbidity, according to the scale designed by Charlson et al and sex, age and stage, according to the 2002 American Joint Committee on Cancer (AJCC) classification staging system, are outlined in Table 1.

Of the 30 tumors, 15 (50%) were confined to the lateral wall of the pyriform sinus. The other 15 tumors had variable extension to neighboring areas, namely, the anterior angle of the pyriform sinus (n = 8), posterior pharyngeal wall (n = 6), trifold region (n = 3) (as depicted in Figures 1 and 2), medial wall of the pyriform sinus (n = 1), aryepiglottic fold (n = 1), subtonsillar region (n = 1), and pharyngeal wall above the trifold region (n = 1).

A preoperative (induction) chemotherapy regimen of cisplatinum and 5-fluorouracil was administered after endoscopic tattoo and mapping to eight patients (26.7%) (stage II, n = 2; stage III, n = 5; stage IV, n = 1). A partial (>50%) clinical T response and a complete clinical T response was observed in four patients and one patient, respectively. No clinical N response was noted.

All patients had a lateral pharyngotomy approach according to the previously described techniques. To be amenable to this conservative surgical procedure, at our institution the following criteria had to be met: the inferior margin of tumor was at least 1 cm from the apex of the pyriform fossa, the postcricoid region, pre-epiglottic space, and thyroid cartilage were not invaded by tumor, and the motion of the true vocal cord and arytenoid cartilage on the tumor-bearing side was normal. From a technical point of view, a few points of clarification of the technique adopted in our institution are necessary: (1) the superior laryngeal nerve was isolated before excision of the tumor, and care was taken not to transect the nerve at the time of resection; (2) the pharyngotomy was performed high if the tumor was low, and vice versa, to allow for tumor excision under direct vision without compromising margins; (3) visualization of the tumor before its excision was facilitated by resection of the ipsilateral horn of the hyoid and completion of an ipsilateral horizontal transvallecular pharyngotomy; (4) tumor excision was facilitated by blue ink tattoo of the macroscopic tumor margins at the time of initial endoscopy; (5) the inferior constrictor muscles were not detached from the lamina of the ipsilateral thy-
roid cartilage, and the posterosuperior aspect of the lamina of the thyroid cartilage was excised in all cases in continuity with the lesion; and (6) the posterior pharyngeal wall was systematically undermined and then mobilized to allow for tension-free primary closure. Although a nasogastric feeding tube was inserted for every patient, tracheotomy was performed in 20 patients (66.7%).

An ipsilateral jugulocarotid lymph node dissection was performed in 27 patients (90%). A selective neck dissection was performed in 10 patients, whereas 17 patients (63%) underwent modified radical/radical neck dissection. No jugulocarotid neck dissection was performed in three patients with N0 necks (two of these had prior radiation therapy to the neck for the management of a laryngeal squamous cell carcinoma, and one refused the neck dissection). Four patients had ipsilateral loboisthectomy. No paratracheal dissections were performed in this series.

Histologic analysis revealed close, positive, and negative margins in three (10%), one (3%), and 26 (87%) patients, respectively. Of those who had induction chemotherapy, histologic analysis revealed a complete T response in two patients, but no complete nodal response was observed.

Of the 27 patients who had an associated jugulocarotid lymph node dissection, nodal metastases were noted in 16 cases (59.2%). In the 10 patients with N0 disease undergoing elective neck dissection, only one patient (10%) had occult metastasis. In the 18 patients with clinically N+ necks, 15 (83%) had pathologically confirmed metastasis. Ten patients had either multiple node involvement (n = 5) or evidence of extracapsular spread (ECS) (n = 5); a single patient had multiple positive nodes with ECS. Postoperative radiotherapy was delivered to 20 patients (67%). A single patient received only 12 Gy, because of radiation therapy–related toxicity. For the remaining 19 patients, the postoperative dose varied from 45 to 65 Gy (median dose delivered, 53 Gy).

Follow-up time was the time from the first presentation in our department until the date of last contact or death. All patients but one, who was followed up for 53 months, were followed up until death. Statistical analysis was performed using a computerized software package (Statview, SAS Institute Inc., Cary, NC). The functional results, as well as significant complications related to the lateral pharyngectomy, and postoperative mortality were determined. In addition, the duration of nasogastric tube feeding, tracheotomy, and hospitalization was calculated. Overall survival and local recurrence were analyzed using the Kaplan–Meier actuarial life-table method with the log-rank test for statistical comparison.

![FIGURE 1](image1.png)

FIGURE 1. The trifold region (*): an artist’s rendering. 1, aryepiglottic fold; 2, pharyngoepiglottic fold; 3, arypharyngeal fold; SG, supraglottic larynx; HP, hypopharynx; OP, oropharynx.

![FIGURE 2](image2.png)

FIGURE 2. Endoscopic visualization of the trifold region. 1, aryepiglottic fold; 2, pharyngoepiglottic fold, and 3, arypharyngeal fold.
variables were analyzed for potential statistical correlation with local recurrence: age, comorbidity (Charlson 0–1 vs 2–4), adjacent sites involved, T stage, chemotherapy (yes vs no and clinical response), pathologic margins (positive/close vs negative), complete histologic regression, and postoperative radiotherapy (yes vs no). The Fisher exact test, Spearman rank correlation, and the nonparametric Mann–Whitney U test were used for statistical analysis. Statistical significance was set at the .05 level. In addition, the consequences of local recurrence in terms of salvage treatment, organ preservation, nodal recurrence, distant metastases, and death are presented and discussed.

RESULTS

Functional Outcome. Overall, 29 patients died in our series (Table 2), resulting, as depicted in Figure 3, in a 77.7%, 40%, 23.3%, and 15% 1-, 3-, 5- and 10-year Kaplan–Meier actuarial survival estimate, respectively. Of these, three (9%) died in the immediate postoperative period. Death was related to a gastrointestinal hemorrhage from a bleeding peptic ulcer in one patient. Another patient died from complications after a traumatic fall. The third patient (not previously irradiated) died from the consequences of a salivary leak. This salivary leak was the only significant postoperative complication related to the lateral pharyngectomy that was noted in our series (3%).

All patients were decannulated. The mean time to decannulation was 8 days (range, 1–32 days). The mean duration of nasogastric tube feeding, which all patients received, was 12 days (range, 7–28 days). There were no cases of pneumonia secondary to aspiration, long-term impaired dysphagia, or dysphonia, and no patients required a gastrostomy and/or completion total laryngectomy for functional reasons. The mean duration of hospitalization was 18 days (range, 12–40 days).

Table 2. Causes of death among 29 patients.

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distant metastasis</td>
<td>7</td>
</tr>
<tr>
<td>Intercurrent disease</td>
<td>6</td>
</tr>
<tr>
<td>Metachronous second primary tumor</td>
<td>4</td>
</tr>
<tr>
<td>Unknown without evidence of disease</td>
<td>4</td>
</tr>
<tr>
<td>Postoperative</td>
<td>3</td>
</tr>
<tr>
<td>Nodal failure</td>
<td>3</td>
</tr>
<tr>
<td>Local tumor evolution</td>
<td>2</td>
</tr>
</tbody>
</table>

Significant complications related to postoperative radiotherapy were noted in three cases (10%) and included persistent laryngopharyngeal edema (n = 1), laryngeal edema requiring temporary tracheotomy (n = 1), temporary swallowing impairment and severe mucositis (n = 1).

Local Recurrence. The 3- and 5-year Kaplan–Meier actuarial local control estimates were 88.5% and 79.6%, respectively (Figure 4). Observed local recurrence occurred in four patients (13.3%). By univariate analysis, the use of a platin-based induction chemotherapy regimen (p = .05; by the Fisher exact test) was the only variable that significantly related to local recurrence. Local recurrence varied from 38% (4 of 8) in patients who had a platin-based induction chemotherapy regimen.
to 4.5% (1 of 22) in patients who did not. From an oncologic perspective, in univariate analysis, local recurrence significantly increased ($p = .08$; by the Fisher exact test) the rate of nodal recurrence. Nodal recurrence varied from 75% in patients who had a local recurrence to 16% in patients who did not. Local recurrence did not increase ($p = .7$) the rate of distant metastasis.

The management of local recurrence was successfully performed in three patients: two had total laryngopharyngectomy with postoperative radiation therapy, and one had a partial pharyngolaryngectomy. The remaining two patients were considered not to be amenable to salvage local treatment and ultimately died with local recurrent tumor. Overall, a 93.3% (28 of 30) laryngeal preservation rate was achieved.

DISCUSSION

Over the past 50 years, several conservative surgical approaches to resect squamous cell carcinoma of the pyriform sinus have been described. These include the partial laryngopharyngectomy, the extended supraglottic laryngectomy, the supracricoid hemilaryngopharyngectomy, and the transoral endoscopic CO$_2$ laser resection. In addition, innovative radiation therapy protocols, including twice-daily hyperfractionation and chemoradiation, have been proposed.

We present here a longitudinal report documenting the results of the lateral pharyngectomy. Although retrospective, our series suggests that, when performed for selected tumors of the lateral wall of the pyriform sinus, this approach is not only oncologically sound but yields a highly functional outcome. In this 30-year experience, only a single patient died from complications related to the surgery. Only two thirds required tracheotomy, and every one of these patients was ultimately decannulated. There were no cases of aspiration pneumonia, long-term dysphagia, or dysphonia. Furthermore, the use of postoperative radiation therapy seemed safe. The average dose was minimized, and each patient averaged 53 Gy. With lowered postoperative dosing, only a single patient required a temporary tracheotomy.

In our opinion, such good functional results achieved in this series cannot be explained only by careful preoperative patient selection. The range of both age and comorbid disease within the study population is wide. This diverse patient population over a long study period attests to both the safety of this surgical approach and its potential for general use. We believe that to achieve such results, surgical technique must be precise to guarantee preservation of the superior laryngeal nerve in this open-field surgical approach. Such functional outcomes should be compared with much higher rates of permanent tracheotomy and gastrostomy when using, on the one hand, hyperfractionated radiotherapy, or, on the other hand, supraglottic or supracricoid hemilaryngopharyngectomy.

Because the incidence of pyriform sinus carcinoma is rare, large adequately powered studies to compare treatment regimens have not been performed. Earlier reports using radiotherapy alone have not been as encouraging, with local recurrences ranging from 23% to 65%. Nonetheless, the literature does clarify the need for combined-modality therapy with radiation therapy and surgery, usually a post-radiotherapy neck. This has emerged as the standard of care for the treatment of these patients.

The University of Texas M. D. Anderson Cancer Center noted good local control rates and validated the importance of hyperfractionation. Two-year actuarial local control rates for patients with T1 and T2 disease were 89% and 77%, respectively. But an analysis of just patients with T2 disease revealed striking differences in actuarial local control rates. For patients receiving twice-daily hyperfractionation, 86% of patients achieved local control compared with 60% of patients receiving standard fractionation ($p = .04$). A quarter of these patients also had neck dissection. Overall 2- and 5-year survival rates were 72% and 52%, respectively. These results are in keeping with our approach emphasizing the need for combined-modality treatment. However, in this experience, surgery was reserved for the neck alone, rather than both the primary tumor and neck in our series.

Amdur et al reported on 101 patients with T1/2 pyriform sinus carcinoma treated with radiotherapy to the primary and post-radiotherapy neck dissection. Actuarial local control was 90% for T1 and 80% for T2 lesions, respectively. Although this approach seems oncologically valid, the functional outcomes were not as clear-cut. First, late complications were seen in 12% of patients, including three patients who died directly from radiotherapy-related sequelae. Total laryngectomy was performed in three patients with T1 disease for chondroradionecrosis functional reasons, and no tumor was found in the specimen. In fact, these three patients were included in the calculation of the ultimate local control rates of...
T1 lesions (95%) and T2 lesions (91%). Finally, five patients required permanent gastrostomy after radiotherapy alone, and another two patients could not swallow for the remainder of their lives until they succumbed to intercurrent disease.

Recently, the advantages of transoral laser microsurgical (TLM) resection for pyriform sinus squamous cell carcinoma have been extolled.\textsuperscript{19,20} citing superior functional outcomes compared with the open surgical approach. Lateral wall pyriform sinus lesions are difficult to expose through the endoscope. Because lateral wall lesions are rarely limited and extend vertically, repositioning the endoscope makes precise margin control unreliable. We believe that these tumors require the wide mucosal and muscular margin that is reproducibly achieved by means of the partial lateral pharyngectomy. The propensity of these lesions to metastasize regionally requires an ipsilateral neck dissection. This can be easily performed at the time of partial lateral pharyngectomy, whereas a separate procedure is needed when using TLM. Finally, the internal carotid artery can be safely managed by means of the open approach, but less so with an endoscopic resection. For these reasons, we believe that the TLM approach should not be considered as the “gold standard” for these lesions.

Strict inclusion criteria were used for this study. All cases were confirmed endoscopically as T1–T2 before surgical resection, and, therefore, no T3–4 lesions were included. In all cases, the inferior margin of the tumor was at least 1 cm from the apex of the pyriform fossa, whereas the postcricoid region, pre-epiglottic space, and thyroid cartilage were not invaded by tumor with normal laryngeal motion. However, the N staging did not preclude the use of this technique, because disease in 18 patients (60%) was classified as stage III–IV (Table 2). Using these preoperative selection criteria and appropriate adjuvant therapy, the observed local control rate was 83% in this study. Four patients (13%) had local recurrence develop. By univariate analysis, the preoperative platin-based induction chemotherapy regimen \((p = .05\) was the only variable that significantly correlated to local recurrence. Local recurrence varied from 50% (4 of 8) in patients who had a platin-based induction chemotherapy regimen to 4.5% (1 of 22) in patients who did not. Overall, the 3- and 5-year Kaplan–Meier actuarial local control estimates were 88.5% and 79.6%, respectively (Figure 4). Using this approach, the selected patients in this study achieved a high rate of local control. The management of local recurrence was successfully performed in three patients: two had total laryngopharyngectomy with postoperative radiation therapy, and one had a partial pharyngolaryngectomy. The remaining two patients were not considered to be amenable to salvage local treatment and ultimately died with local recurrent tumor.

Thus, an overall 93% (28 of 30) laryngeal preservation rate was achieved. On the basis of this retrospective study, we certainly cannot recommend that every patient with “early”-stage lateral pyriform sinus cancer have this primary surgical approach. Instead, given these comparable rates of local control, functional outcomes, and laryngeal preservation, it should be considered. Although comparable rates of local and regional control can be achieved with radiotherapy, the functional outcome of these patients is not as good.

Our report supports the use of primary surgery followed by a less intensive radiotherapy regimen. We believe this approach maximizes long-term functional outcomes, probably by diminishing the total dose of radiotherapy. However, to determine this, future multi-institutional prospective comparative studies are needed to validate this approach.

REFERENCES


