Abstract: Surgery is the preferred modality for curative treatment of recurrent laryngeal cancer after failure of nonsurgical treatments. Patients with initial early-stage cancer experiencing recurrence following radiotherapy often have more advanced-stage tumors by the time the recurrence is recognized. About one third of such recurrent cancers are suitable for conservation surgery. Endoscopic resection with the CO₂ laser or open partial laryngectomy (partial vertical, supracricoid, or supraglottic laryngectomies) have been used. The outcomes of conservation surgery appear better than those after total laryngectomy, because of selection bias. Transoral laser surgery is currently used more frequently than open partial laryngectomy for treatment of early-stage recurrence, with outcomes equivalent to open surgery but with less associated morbidity. Laser surgery has also been employed for selective cases of advanced recurrent disease, but patient selection and expertise are required for application of this modality to rT3 tumors. In general, conservation laryngeal surgery is a safe and effective treatment for localized recurrences after radiotherapy for early-stage glottic cancer. Recurrent advanced-stage cancers should generally be treated by total laryngectomy. © 2011 Wiley Periodicals, Inc. Head Neck 34: 727–735, 2012

Keywords: larynx; squamous cell carcinoma; radiation failure; recurrence; salvage surgery; conservation laryngeal surgery

The treatment of laryngeal cancer by primary nonsurgical therapy (radiotherapy or chemoradiotherapy), with the goal of preservation of the functional...
Diagnosis and Treatment of Recurrent Laryngeal Cancer

DIAGNOSIS OF RECURRENT LARYNGEAL CANCER

Evaluation of the larynx after initial treatment, and after (chemo)radiotherapy in particular, remains challenging despite endoscopy and the availability of modern imaging studies. Postradiotherapy changes include fibrosis, edema, and soft tissue and cartilage necrosis. The growth pattern of recurrent laryngeal carcinomas is different from that of primary carcinomas. Many recurrences present with multicentric tumor foci, localized below an intact mucosa, and further masked by post-treatment edema and fibrosis. The identification of a recurrent tumor by endoscopic examination may be difficult with the risk of false-negative biopsies if they are superficial or not in multiple areas. CT and MRI do not allow sufficient differentiation between recurrent tumor and the sequelae of (chemo)radiotherapy. Moreover, after radiotherapy, patient-reported symptoms (hoarseness, odynophagia, and pain) may be similar to those from individuals with cancer recurrence. Laryngeal mobility may be impaired by fibrosis or masked by edema, as well. Therefore, distinguishing between recurrent carcinoma and the sequelae of (chemo)radiotherapy can be a challenging clinical problem. Laryngeal biopsy can exacerbate postradiotherapy changes and can occasionally lead to chondritis, failure to heal, and further edema. In addition, biopsies in previously treated areas may be falsely negative as a result of sampling error or missed deep residual tumor.

Because the recurrence rates after (chemo)radiotherapy for advanced-stage tumors range from 25% to 50%, early diagnosis of cancer recurrence is essential. Brouwer et al evaluated the methods used for identifying recurrent laryngeal carcinoma and found that, although indirect laryngoscopy had a sensitivity of 87%, the specificity was only 14%. Symptoms such as dysphonia, pain, and dysphagia were neither sensitive nor specific. Most surgeons would agree that frequent posttreatment office examinations, with direct laryngoscopy and biopsies when any change is noted, constitute the most reliable method for detecting local recurrence. Brouwer et al evaluated the use of direct laryngoscopy and biopsy under general anesthesia in a retrospective study of 207 patients. In 131 patients who were suspected of having recurrent laryngeal carcinoma after radiotherapy, 70 patients (53%) were negative. However, during the next 6 months, 22 of these biopsies (31%) were later shown to be false negatives. This study shows the difficulty of obtaining sufficient biopsies. In another 11 patients (16%), recurrence occurred >6 months after the initial negative laryngoscopy. The majority of recurrences were detected within 12 months. Thirty-seven patients (28%) remained disease free, but they underwent 65 costly and negative laryngoscopies.

The yield of direct laryngoscopy in the detection of recurrent laryngeal carcinoma after (chemo)radiotherapy may be improved by patient selection based on imaging techniques. Conventional anatomical imaging techniques such as CT and MRI do not consistently detect persistent or recurrent tumor following (chemo)radiation. The diffuse tissue changes from radiation (including fibrosis and edema) result in a low specificity for tumor detection. CT imaging has
limitations in evaluating thyroid cartilage involvement and extralaryngeal spread, even in previously untreated patients. However, the combination of a baseline, posttreatment and follow-up CT or MRI can help improve detection of recurrent laryngeal carcinoma. Since the tumor may continue to regress over time, imaging assessment of response should not be done too soon after (chemo)radiotherapy. To avoid false-positive results, a minimum interval of 8 to 12 weeks posttherapy prior to the first imaging study is reasonable.

One method of improving the detection of recurrent cancer is by functional imaging with fluorodeoxyglucose–positron emission tomography (FDG-PET). Most studies show a high accuracy for FDG-PET in the detection of local and regional recurrence of head and neck cancer after different treatment modalities. However, only a limited number of studies have studied the detection of recurrent laryngeal carcinoma using FDG-PET. The validity of the FDG-PET studies was reasonable, with pooled estimates for sensitivity and specificity of 89% and 74%, respectively. In a pilot study of 30 patients suspected of recurrent laryngeal carcinoma after radiotherapy, conservative (equivocal analyzed as negative) and sensitive (equivocal analyzed as positive) assessment strategies were compared with the reference standard (27% recurrence within 6 months after PET). For the conservative and sensitive assessment strategies, the sensitivity was 87% and 97%, specificity was 81% and 63%, positive predictive value was 61% and 46%, and negative predictive value was 96% and 99%, respectively. In clinical practice, the sensitive assessment strategy is valuable if FDG-PET is used to select patients suspected of recurrent laryngeal carcinoma for direct laryngoscopy. The promising diagnostic accuracy of FDG-PET justifies a randomized trial comparing a strategy based on conventional diagnostic work-up with FDG-PET. In The Netherlands, the multicenter prospective randomized recurrent laryngeal carcinoma after radiotherapy PET study (RELAPS) trial has recently been completed. The aim of this study was to investigate whether the application of FDG-PET could reduce the number of futile direct laryngoscopies without an increase in detecting cancer when incurable and reduce costs as compared with a conventional diagnostic work-up.

In current clinical practice, the integrated PET/CT scan has largely replaced the PET scan alone. PET/CT allows for overlap of molecular and anatomic findings. The improved value of PET/CT compared with PET in detecting recurrent laryngeal cancer remains unproven.

Another promising novel approach in imaging recurrent disease is diffusion-weighted MRI. Two studies demonstrated that diffusion-weighted MRI has promising results for differentiating residual or recurrent head and neck tumors from postoperative or postradiation changes. Larger studies on diffusion-weighted MRI, including patients with tumors at specific sites and undergoing different treatments, are needed.

Similarly, CT perfusion is another modification of a standard imaging technique that may permit better differentiation between local tumor recurrence and nonspecific posttherapy tissue changes. As shown by Bisdas et al, the values of perfusion parameters are significantly higher in tumor tissue compared with normal structures, including tissue changes after chemoradiotherapy.

**SALVAGE SURGERY FOR EARLY-STAGE LARYNGEAL TUMORS**

After treatment with radiotherapy, the rate of recurrence in patients with T1 tumors of the larynx ranges from 5% to 13%, and in patients with T2 tumors, from 25% to 30%. The majority of cases require total laryngectomy in cases of recurrence. Deganello et al reported on a series of patients with locoregional recurrences of early laryngeal carcinomas were evaluated. They verified that among the 289 cases that were submitted to salvage surgery, 226 patients (78.2%) underwent total laryngectomy, whereas just 31 patients (10.7%) underwent supracricoid laryngectomy and 32 patients (11.1%) to other types of surgical procedures with voice preservation, including CO2 laser resections and vertical laryngectomies. Other authors have demonstrated that in the majority of patients who develop local recurrence after treatment of initial tumors of the larynx, total laryngectomy continues to be the main therapeutic option. Endoscopic surgery and open partial surgery are feasible in only carefully selected patients. In the majority of cases, advanced-stage tumors rT3 and rT4, comorbidities, the toxicity of the previous radiotherapy treatment which frequently involves significant edema of the laryngeal and hypopharyngeal mucosa, fibrosis, and other complications such as chondronecrosis, usually make it infeasible to perform surgeries with larynx function preservation. Patients with tracheostomy at the time when salvage surgery is indicated are usually not candidates for larynx-preservation procedures. Furthermore, patients who already have significant swallowing dysfunction at the time of diagnosis of recurrence are not good candidates for conservative surgery. It has been postulated that approximately only one third of early carcinomas of the larynx that develop recurrence are suitable for partial laryngectomy.

Conservation surgery with preservation of voice and deglutition has been the treatment option of choice for initial recurrences of carcinomas of the larynx that present in stages rT1 and rT2, although selected cases of rT3 tumors may also be eligible for these procedures and have been included in published series. At the present time, many conservative types
of surgery are performed by an endoscopic approach with use of the CO₂ laser. This technique is especially helpful for superficial tumors and cancers that do not involve the anterior commissure. The open approaches most often used are vertical laryngectomies and supracricoid laryngectomies. Partial vertical procedures are most often used for T1 tumors that involve the anterior commissure. Supraglottic laryngectomy may rarely be performed; however, because of difficult rehabilitation of deglutition in combination with significant morbidity and a high incidence of local recurrence, the use of supraglottic laryngectomy for treatment of recurrent tumors after radiation failure is controversial and is now rarely done. Supracricoid laryngectomy is used for recurrent cancers that are classified as rT2 or are too extensive to remove by endoscopic laser or partial vertical procedures.

Which approach should be chosen depends on the experience of the surgeon and on the extent of the primary tumor and the recurrence itself. For recurrent cancers, any of the following conditions are usually considered contraindications for partial laryngectomies: arytenoid fixation, infiltration of the interarytenoid area, extensive infiltration of the preepiglottic space, subglottic extension, and extralaryngeal infiltration. In addition, tissue damage from previous irradiation and the tendency for recurrent tumors to extend submucosally rather than to have clearly defined margins on the mucosal surface limit the number of cases suitable for conservation surgery. Finally, visualization of the larynx under direct suspension microlaryngoscopy may be impossible or insufficient after radiotherapy as a result of neck fibrosis, contraindicating the use of transoral laser surgery in these cases.

Patients selected for conservation surgery of the larynx must have adequate lung function to cope with possible (micro)aspiration of food during the postoperative period. Advanced age and associated comorbidities are other clinical variables that often are contraindications for conservation procedures. For these patients, total laryngectomy is a safer alternative with less morbidity and mortality.

Ganly et al evaluated 43 patients with laryngeal squamous cell carcinoma, clinical stage I and stage II, who developed local disease recurrence after initial radiotherapy. Twenty-one of these patients (48.8%) were deemed suitable for conservation surgery. One patient had endoscopic resection with the CO₂ laser, 7 patients had cordectomy by laryngofissure, 11 patients had frontolateral laryngectomy, and 2 patients underwent supracricoid laryngectomy. None of these patients had nodal dissection. Total laryngectomy was performed for the remaining 22 patients (51.2%). The overall survival of patients submitted to conservation surgery was better than that for those submitted to total laryngectomy (89% and 50%, respectively), as expected, because these former patients had less advanced recurrent tumors. The authors concluded that if carefully selected, partial laryngectomies are a safe alternative for the treatment of initial recurrences of laryngeal carcinomas, although this approach was feasible in fewer than 50% of the patients.

Holsinger et al studied 105 patients with recurrent laryngeal carcinomas after radiotherapy for T1 and T2 laryngeal cancers. Seventy-three patients (69.5%) required total laryngectomy and only 32 patients (30.5%) underwent conservation procedures, including 6 endoscopic resections and 26 partial laryngectomies performed by open techniques. Locoregional control was obtained in 86.7% of patients with total laryngectomy and in 84.4% of patients after conservation surgery. Among the conservation group, 5 of 32 patients (15.6%) had recurrence after salvage surgery. Four local recurrences were further treated by total laryngectomy, 1 successfully, whereas 3 subsequently developed stomal recurrence. One of the 5 patients had unresectable regional recurrence. Distant metastases occurred in 13 patients.

Steiner et al presented their experience with 34 patients with local recurrence of squamous cell carcinoma of the larynx after radiotherapy (initial stage unspecified), which included 11 patients with rT1, 10 with rT2, 10 with rT3, and 3 patients with rT4 disease. Twenty-four patients (71%) were alive and disease-free after 1 or more endoscopic procedures, with a median follow-up period of 38.6 months. One patient had a total laryngectomy as the result of necrosis of the laryngeal cartilage. Nine patients presented with recurrences that could not be controlled by endoscopic surgery (26%): 3 were treated palliatively, and 6 underwent total laryngectomy. The cancer-specific survival at 5 years was 86%. Compared with salvage laryngectomy, the results of laser endoscopic resections were superior with respect to preservation of laryngeal function. It was noted that great expertise is required, particularly in resections of advanced recurrent carcinomas. The authors concluded that endoscopic surgery with the use of CO₂ laser could be an alternative for recurrent carcinomas of the larynx after radiotherapy, even in selected cases of more advanced tumors.

Piazza et al presented the treatment results of 71 patients with recurrent squamous cell carcinoma of the larynx after initial treatment with radiotherapy (including 10 patients who presented with a second primary laryngeal tumor). Patients were treated either with endoscopic surgery (22 patients), open conservation surgery (15 patients), or total laryngectomy (34 patients). Among the 22 patients (30%) treated with endoscopic surgery, 14 were alive and disease-free at the end of follow-up (1 patient was submitted to salvage total laryngectomy; 3 patients...
required another endoscopic procedure for local control of the disease, 1 patient developed stomal recurrence, and 6 patients died from other causes. The cancer-specific survival for endoscopic surgery was 95% at 5 years, and the rate of larynx preservation was 75%. The cancer-specific survival for open conservation surgery was 100%, and the rate of larynx preservation was 83%. There was no statistical difference in cancer-specific survival between the patients treated with endoscopic and open surgery. Thirty-four patients (49%) were treated with total laryngectomy, and the cancer-specific survival associated with this therapy was 48%. The authors concluded that survival rates for the entire series were not different from those previously reported using only total laryngectomy. The larynx-preservation rate justifies conservation treatment in the presence of limited recurrent lesions.

Motamed et al.38 published a literature review of treatment of recurrent squamous cell carcinomas of the larynx after initial treatment with radiotherapy, comparing the 2 conservation treatment alternatives of endoscopic surgery with CO2 laser and open partial laryngectomy. In this review, 407 patients underwent open surgery, and 145 patients underwent endoscopic surgery. Among patients who underwent open surgery, local control ranged from 56% to 100%, with a pondered mean of 77%. In 15% of the cases, salvage total laryngectomy was necessary for a second recurrence. When salvage total laryngectomies were included, the pondered mean of local control was 90%. In the group of patients who underwent endoscopic surgery, more than 1 endoscopic resection procedure was necessary in 40% of the cases. Local control ranged from 51% to 87%, with a pondered mean of 65%. Salvage total laryngectomy was required for 25% of the patients, raising the pondered mean of local control to 83%. The authors concluded that conservation laryngeal surgery is a safe and effective treatment for recurrent localized disease after radiotherapy for early-stage glottic cancer. Local control may be achieved without the sacrifice of laryngeal function, and total laryngectomy may be held in reserve as the ultimate option for salvage without compromising ultimate survival.

In another series, Marioni et al.39 examined the role of supracricoid laryngectomy for glottic carcinoma recurrence after radiotherapy. Although the majority (84.5%) of the 103 cases treated with salvage supracricoid laryngectomy for radiation failure did not present with a new local recurrence, two thirds of the remaining laryngeal recurrences after salvage supracricoid laryngectomy were successfully treated with total laryngectomy. Decannulation was possible in all but 2 cases after a period ranging between 12 and 28 days. Swallowing results were considered good. Voice quality determined by psychoacoustic methods was acceptable. The authors anticipate that in the future, salvage supracricoid laryngectomy will be used more extensively for failure of radiotherapy for glottic carcinoma.

Published series on conservation salvage surgery, both endoscopic and open approaches, are summarized in Table 1.8,9,32,36,37,40–61 The series are heterogeneous because of different selection criteria; therefore, the results are not always comparable. Some series included only early-stage tumors, whereas others also included advanced disease. Others included recurrences and second primary tumors within the previously irradiated field. Local control rates also were reported in different ways.

### Table 1. Local control rates after a single procedure of transoral endoscopic laser surgery or open partial laryngectomy.

<table>
<thead>
<tr>
<th>Procedure/reference</th>
<th>Year of publication</th>
<th>No. of patients (after different intervals)</th>
<th>Local control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transoral laser</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arinyas et al 40</td>
<td>1984</td>
<td>10</td>
<td>50%</td>
</tr>
<tr>
<td>Bilakesle et al 41</td>
<td>1984</td>
<td>15</td>
<td>40%</td>
</tr>
<tr>
<td>Casiano et al 42</td>
<td>1991</td>
<td>16</td>
<td>56%</td>
</tr>
<tr>
<td>Ouzten and Illum 43</td>
<td>1995</td>
<td>15</td>
<td>70%</td>
</tr>
<tr>
<td>Quer et al 44</td>
<td>2000</td>
<td>24</td>
<td>75%</td>
</tr>
<tr>
<td>de Gier et al 45</td>
<td>2001</td>
<td>40</td>
<td>42%</td>
</tr>
<tr>
<td>Steiner et al 46</td>
<td>2004</td>
<td>34</td>
<td>38%</td>
</tr>
<tr>
<td>Sewnaik et al 46</td>
<td>2005</td>
<td>42</td>
<td>52%</td>
</tr>
<tr>
<td>Piazza et al 47</td>
<td>2007</td>
<td>22</td>
<td>68% (63% DFS)</td>
</tr>
<tr>
<td>Grant et al 48</td>
<td>2008</td>
<td>65</td>
<td>88%</td>
</tr>
<tr>
<td>Roedel et al 49</td>
<td>2010</td>
<td>53</td>
<td>39%</td>
</tr>
<tr>
<td>Open partial laryngectomy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bille et al 40</td>
<td>1970</td>
<td>18</td>
<td>78%</td>
</tr>
<tr>
<td>Sorensen et al 41</td>
<td>1980</td>
<td>55</td>
<td>82%</td>
</tr>
<tr>
<td>Rothfield et al 42</td>
<td>1990</td>
<td>14</td>
<td>79%</td>
</tr>
<tr>
<td>Lavey and Calcatera 43</td>
<td>1991</td>
<td>25</td>
<td>96%</td>
</tr>
<tr>
<td>Shaw 44</td>
<td>1991</td>
<td>54</td>
<td>83%</td>
</tr>
<tr>
<td>Dei Gaudio et al 45</td>
<td>1994</td>
<td>22</td>
<td>82%</td>
</tr>
<tr>
<td>Kooper et al 46</td>
<td>1995</td>
<td>61</td>
<td>85%</td>
</tr>
<tr>
<td>Laccourreye et al 47</td>
<td>1996</td>
<td>12</td>
<td>83%</td>
</tr>
<tr>
<td>Riful et al 48</td>
<td>2002</td>
<td>45</td>
<td>95%</td>
</tr>
<tr>
<td>Toma et al 49</td>
<td>2002</td>
<td>19</td>
<td>84%</td>
</tr>
<tr>
<td>Clark et al 50</td>
<td>2005</td>
<td>6</td>
<td>100%</td>
</tr>
<tr>
<td>Makeiff et al 51</td>
<td>2005</td>
<td>23</td>
<td>74%</td>
</tr>
<tr>
<td>Sewnaik et al 52</td>
<td>2005</td>
<td>21</td>
<td>71%</td>
</tr>
<tr>
<td>Gally et al 53</td>
<td>2006</td>
<td>20</td>
<td>95%</td>
</tr>
<tr>
<td>Piazza et al 54</td>
<td>2007</td>
<td>15</td>
<td>87% (33% DFS)</td>
</tr>
<tr>
<td>Deganello et al 55</td>
<td>2008</td>
<td>31</td>
<td>75%</td>
</tr>
<tr>
<td>Luna-Ortiz et al 56</td>
<td>2009</td>
<td>8</td>
<td>87%</td>
</tr>
<tr>
<td>Combined transoral and open</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holsinger et al 57</td>
<td>2006</td>
<td>32</td>
<td>84%</td>
</tr>
</tbody>
</table>

Abbreviation: DFS, (5-year) disease-free survival.

### SALVAGE SURGERY FOR ADVANCED-STAGE LARYNGEAL TUMORS

The treatment for advanced cancer of the larynx has continued to evolve over the last 30 years. Combined radiotherapy and chemotherapy, given with the intent of preserving the larynx as well as cure, is used for many patients as primary treatment. However, this should be done only if there are no significant comorbidities and surgical conservation options, if applicable, are also discussed with the patient. Patients with
mobile vocal cords rarely require a total laryngectomy as a primary surgical option. Most patients with T4 tumors will require a total laryngectomy and many are not good candidates for chemoradiotherapy because of tumor bulk or deep infiltration. Total laryngectomy is also used as salvage treatment for patients who do not respond to nonsurgical treatment, or for those who develop a local recurrence. Persistent disease or local recurrence of the primary tumor occurs in approximately 30% of patients with advanced laryngeal cancer submitted to nonsurgical organ-preservation treatments.68,69 For these patients, the best treatment with curative intent is total laryngectomy. The Radiation Therapy Oncology Group (RTOG) 91-11 study64,65 evaluated 517 total laryngectomies, the best treatment with curative intent is total laryngectomy. The Radiation Therapy Oncology Group (RTOG) 91-11 study64,65 evaluated 517 patients with advanced squamous cell carcinoma of the larynx who were submitted to radiotherapy-based treatment with the intention of preserving the larynx. The cohort was divided into 3 study arms: radiotherapy alone, induction chemotherapy followed by radiotherapy, and concomitant chemoradiotherapy. Salvage total laryngectomy was required for 129 patients (25%), not only as the result of recurrent tumor but also because of residual disease, patient refusal to continue organ preservation treatment on protocol, necrosis, and laryngeal dysfunction. The frequency of salvage laryngectomy was lowest (16%) and significantly different in patients treated with concomitant chemoradiotherapy compared with the induction chemotherapy (28%) and radiotherapy only (31%) arms. In other larynx-preservation trials,66,67 locoregional control and overall survival rates were comparable to those from the RTOG 91-11 report. However, concerns have been expressed because of the extrapolation of results from highly selected randomized trials that included many patients with mobile vocal cords to a general population of “advanced tumors.” Survival for laryngeal cancer in general has been shown to be lower now compared with pre-chemoradiotherapy periods, and survival for patients with T4 tumors may be best with surgery.68

COMPPLICATIONS AND MORBIDITY AFTER SURGICAL TREATMENT OF THE PREVIOUSLY IRRADIATED LARYNX

Ganly et al69 published an experience with 150 patients who underwent open partial laryngectomy, with 21 patients being submitted to salvage surgery after the failure of radiotherapy. The overall rate of postoperative complications was 20%. There was no postoperative mortality. Both local complications and laryngocutaneous fistulas were more common in the group submitted to salvage surgery. There is no report on the need for surgical re-intervention as a result of postoperative complications. The authors concluded that the postoperative complication rate is low and the procedure is safe, even for patients previously treated with radiotherapy.

Supracricoid laryngectomies are associated with a higher postoperative complication rate and greater morbidity. In a study evaluating 31 patients who underwent salvage supracricoid laryngectomy (23 cri-cohoidoepiglottopexy [CHEP] and 8 crico-oidoepiglottopexy [CHP]), the authors found an overall complication rate of 16.13%. Nevertheless, 3 patients (9.67%) required surgical re-intervention to treat severe local complications. In 1 case it was necessary to perform total laryngectomy and in another a pectoralis major myocutaneous flap was necessary to treat a pharyngocutaneous fistula. Among the 28 patients in whom the larynx was retained (in 3 cases total laryngectomy was necessary for oncologic reasons), laryngeal function restoration was achieved in 25 patients (89.29%). The mean time of decannulation was 27 days (ranging from 14 to 59 days), and the mean time for rehabilitating oral ingestion was 30 days (ranging from 12 to 72 days).

Makeieff et al50 evaluated 23 patients with recurrence of glottic carcinoma submitted to salvage supracricoid laryngectomy. Hospitalization time ranged from 15 to 72 days, with a mean of 30 days. Time of decannulation ranged from 14 to 90 days, with a mean of 28 days. The time the feeding tube remained in place ranged from 10 to 96 days, with a median of 25 days. One patient required percutaneous endoscopic gastrostomy (PEG) feedings. Two patients died as a result of aspirative pneumonia. Three years after surgery, 7 patients still presented with dysphagia (cough while ingesting liquids).

In a study that involved 5 Italian institutions, Pel-olini et al70 evaluated 78 patients who underwent supracricoid partial laryngectomy. In 62 patients CHEP (79.5%) was performed, and in 16 patients CHP (20.5%) was performed. Resection of 1 arytenoid was performed in 33/62 cases of CHEP and in 8/16 cases of CHP. Hospitalization time ranged from 13 to 95 days (median, 23 days). The operative mortality in this cohort was 1.3% (1 patient died of heart failure). Twenty-one patients presented early postoperative complications (within the first 30 days), with the most common being neck abscess (6.4%) and pneumonia (8.9%). One patient presented with cervical bleeding that required re-intervention. Late complications (after 30 days) occurred in 14 patients (17.9%), among them granuloma of the subglottis, edema of the aryte- noids, and pneumonia as a result of food aspiration. These complications were conservatively managed in the majority of cases, either with medical treatment (antibiotic therapy and or corticotherapy) or with en- doscopic surgery. The time of the feeding tube remaining ranged from 12 to 90 days, a mean time of 15 days. Swallowing was successfully rehabilitated (feeding tube removal) in <1 month in 48 patients (61.5%) and in up to 3 months for 97.45% of the patients. For 6 patients it was necessary to use PEG feedings, and in 2 cases full rehabilitation of swallowing was not
possible and the patients continued with the use of PEG feedings. The time to tracheostomy decannulation ranged from 12 to 365 days, with a median of 40 days. Only 2 patients were not decannulated. Voice quality was evaluated in the 76 decannulated patients and was considered hoarse in all cases, although intelligible at all times.

On the other hand, Clark et al.69 presented their experience with 6 patients who underwent supracricoid laryngectomy salvage surgery (4 CHEP and 2 CHP). Operative mortality was 33%. Half of the patients presented with major complications, and 1 of these patients required total laryngectomy as a result of pexy rupture. PEG tube placement was necessary in all patients, and the time for feeding tube removal ranged from 71 to 299 days.

Salvage total laryngectomy has been associated with high rates of postoperative complications in many series published in the literature. Furuta et al.71 evaluated 86 patients who underwent total laryngectomy, with 35 patients not having been submitted to any previous treatment; 17 patients had radiotherapy, and 34 patients had previous treatment with chemoradiotherapy. There was a higher incidence of major complications (bleeding, pharyngocutaneous fistula, operative wound infection associated with necrosis of the flaps) among the patients who underwent previous treatment (41.2% for previous chemoradiotherapy, 29.4% for previous radiotherapy, and 11.4% for the patients without previous treatment). The authors verified that among the patients who presented with pharyngocutaneous fistula, in the group previously treated with chemoradiotherapy, there was need for reoperation in 5 of 8 cases (62.5%).

Ganly et al.72 presented an experience with 183 patients who underwent total laryngectomy; as salvage surgery in 70 cases. Among these patients, 32 had been treated with radiotherapy only and 38 patients to chemoradiotherapy. Over 50% of the patients submitted to chemoradiotherapy developed postoperative complications. Local complications occurred in 44.7% of the patients previously submitted to chemoradiotherapy, when compared with 24.8% of the patients without previous treatment, and 21.9% of the patients after previous radiotherapy (p = .02). The incidence of pharyngocutaneous fistula was 31.6% among the patients previously submitted to chemoradiotherapy; 12.4% among those without previous treatment; and 11.9% among the patients with previous radiotherapy (p = .012). In multivariate analysis, previous treatment with chemoradiotherapy was confirmed as a significantly predictive factor to major complications after salvage total laryngectomy. Weber et al.,65 analyzing the data of patients who underwent salvage surgery in RTOG 91-11, verified an overall rate of 59% of postoperative complications and an incidence of 30% of pharyngocutaneous fistula among patients who had chemoradiotherapy.

The rate of pharyngocutaneous fistula following salvage laryngectomy in irradiated patients (especially following chemoradiotherapy protocols) is considered significantly higher than the rate of fistula following laryngectomy as the initial treatment.72–75 Various studies report not only an increased rate of fistula following chemoradiotherapy but also a more protracted course of fistula and a higher need for additional surgical interventions to treat the fistula.73,75 Because of the high incidence of pharyngocutaneous fistula and morbidity associated with them, some authors have defended the use of myocutaneous flaps, or free flaps, to protect the suture line of pharynx reconstruction after salvage total laryngectomy. The pectoralis major myocutaneous flap was used for the prevention of pharyngocutaneous fistula by Khafif and colleagues (unpublished data, personal communication) and reduced the rate of fistula from 63% to 28% (p = .004). They recommend that the pectoralis major myocutaneous flap should be considered in every patient treated by salvage laryngectomy after prior chemoradiotherapy. Gil et al.76 analyzed 80 patients submitted to salvage total laryngectomy. In 11 patients (14%) the pectoralis major myocutaneous flap was used to protect the suture of the pharynx. The incidence of fistula was not lower in patients in which the flap was used (24% for nonpectoralis major myocutaneous flap and 27% for pectoralis major myocutaneous flap). Nevertheless, for 50% of the patients in whom the myocutaneous flap was not used, there was a need for surgical reoperation, whereas no reoperation was necessary in any of the cases in which the myocutaneous flap was used. The authors recommended the use of pectoralis major myocutaneous flap for patients who present a high risk of developing pharyngocutaneous fistula after salvage total laryngectomy, particularly those who were previously submitted to chemoradiotherapy. Withrow et al.77 demonstrated the advantages of the use of free flaps to protect the pharynx suture line in patients submitted to salvage total laryngectomy after treatment with radiotherapy or chemoradiotherapy. Seventeen patients (46%) underwent free flap reconstruction and 20 patients (54%) underwent primary closure. The number of fistulas was higher in the group of patients who did not have free flaps to protect the pharynx suture (50% vs 17.6%). There was a lower rate of stricture formation and a shorter time of remaining with the feeding tube in the group of patients that received free flaps.

**CONCLUSIONS**

Surgery is the main treatment for recurrent laryngeal cancer after failure of nonsurgical treatment. Recurrent tumor after radiotherapy is frequently detected only when advanced. For cases classified as rT1 or rT2, larynx-conservation surgery may be considered. Approximately one third of the recurrences after treatment of early-stage cancer are amenable to
conservation techniques using endoscopic CO2 laser surgery or open partial laryngectomy. Proper patient selection is warranted for conservation surgery to result in optimal oncologic and functional results. Most cases of recurrent advanced cancers are best treated with total laryngectomy.

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REFERENCES
