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ORGAN PRESERVATION WITH RADIOTHERAPY FOR T1-T2 CARCINOMA OF THE PYRIFORM SINUS

Robert J. Amdur, MD,¹ William M. Mendenhall, MD,¹ Scott P. Stringer, MD,²
Douglas B. Villaret, MD,² Nicholas J. Cassisi, DDS, MD²

¹ Department of Radiation Oncology, University of Florida Health Science Center, PO Box 100385, Gainesville, Florida 32610-0385. E-mail: amdurrj@shands.ufl.edu

² Department of Otolaryngology, University of Florida College of Medicine, Gainesville, Florida

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Abstract: *Purpose.* To report long-term results using radiotherapy with or without a planned neck dissection for T1-T2 carcinoma of the pyriform sinus.

Methods. An analysis of 101 patients treated at the University of Florida with RT with or without a planned neck dissection for organ preservation.

Results. The 5-year local control rates after RT were 90% for T1 cancers and 80% for T2 lesions. The only parameter that significantly influenced local control in univariate analyses was apex involvement for T1 tumors. Multivariate analysis revealed no parameter that significantly affected local control. Cause-specific survival rates at 5 years were as follows: stage I-II, 96%; stage III, 62%; stage IVA, 49%; and stage IVB, 33%. The absolute survival rates were as follows: stage I, 57%; stage II, 61%; stage III, 41%; stage IVA, 29%; and stage IVB, 25%. Moderate to severe long-term complications developed in 12% of patients.

Conclusions. RT alone or combined with a planned neck dissection resulted in local control with larynx preservation in a high proportion of patients. The chance of cure is comparable to that observed after conservation surgery, and the risk of major complications is lower. The addition of adjuvant chemotherapy is unlikely to improve the probability of organ preservation, but might improve locoregional control for patients with advanced nodal disease. © 2001 John Wiley & Sons, Inc. *Head Neck* 23: 353-362, 2001.

Keywords: hypopharyngeal neoplasms; organ preservation; radiotherapy; treatment outcome

A variety of treatment options are currently available for patients with T1 and T2 carcinoma of the pyriform sinus.¹ At one end of the spectrum is radical surgery with removal of the larynx and the involved portion of the hypopharynx. Such an approach results in a high probability of tumor control, but the morbidity associated with disruption of the organs responsible for speech and swallowing is high. The results of conservation surgery are encouraging and suggest that selected patients are likely to be cured with partial laryngopharyngectomy. Another option for larynx conservation for patients with favorable, low-volume lesions is RT. The choice of larynx-conserving treatment (surgery vs RT) has been addressed and remains controversial.²

A separate question is the benefit of adjuvant chemotherapy when RT is used to control tumor at the primary site. Recent studies of patients with locally advanced squamous cell carcinoma of the head and neck suggest that tumor control with organ preservation is better with chemotherapy plus RT compared with RT alone.^{3,4} En-

Correspondence to: R. J. Amdur
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thusiasm over results from combined modality studies has created an environment in which some oncologists are using aggressive chemotherapy regimens in patients with favorable tumors that have high locoregional control rates with RT or conservation surgery. In view of the morbidity and expense of chemotherapy in this setting, it is important to limit the use of combined modality treatment to patients who are likely to have local tumor recurrence develop after treatment with RT alone. As has been previously observed, *"It should be noted that radiation oncology was successfully preserving some organs decades before neoadjuvant chemotherapy became synonymous with the term 'organ preservation.'"*⁵

For more than 20 years, the policy at the University of Florida has been to treat patients with favorable stage T1-T2 pyriform sinus carcinoma by using RT alone or RT combined with a planned neck dissection.⁶ The purpose of this article is to update our experience with an emphasis on the ability of RT to cure patients with preservation of the larynx.

MATERIALS AND METHODS

This is an analysis of 101 patients with stage T1-T2, N0-N3, M0 squamous cell carcinoma of the pyriform sinus who were treated with curative intent using RT alone or combined with a planned neck dissection at the University of Florida between November 1964 and June 1997. Data were analyzed in August 1999. All patients had follow-up for a minimum of 2 years after treatment, and 87% of patients had follow-up for a minimum of 5 years. No patient was lost to follow-up. Patient age ranged from 43 to 83 years (mean, 62 years). Eighty-seven percent of patients were men. Diagnosis of squamous cell carcinoma of the pyriform sinus was confirmed by review of tissue from the primary site. Patients were staged according to the 1992 American Joint Committee on Cancer (AJCC) staging system.⁷ According to this staging system, patients with stage T1 tumors have disease confined to one subsite in the pyriform sinus without fixation of the hemilarynx. Stage T2 tumors involve more than one subsite or an adjacent site without fixation of the hemilarynx. Patients were considered to be good candidates for RT if they had T1 cancers or T2 tumors that were exophytic and low volume. It was desirable for patients to have normal vocal cord mobility and an uninvolved apex. AJCC stage IV was divided into a favorable subset, stage IVA (T1-T2, N2 or N3), and an unfavorable subset, stage IVB (N2c).⁸

Extent of tumor in the pyriform sinus was determined by physical examination and direct laryngoscopy. Because this series spans a period in which CT was not routinely used for staging head and neck cancer, only 48% of patients in this report were imaged with CT before treatment.

Patient distribution according to overall stage was as follows: I, 7 (6%); II, 18 (18%); III, 20, (20%); IVA, 44 (44%); and IVB, 12 (12%).

The distribution of patients according to N stage was as follows: N0, 27 (27%); N1, 17 (17%); N2a, 7 (6%); N2b, 23 (23%); N2c, 12 (12%); and N3, 15 (15%).

Tumor extension to the apex of the pyriform sinus was detected by direct laryngoscopy and/or CT scan in 3 of 22 patients (14%) with stage T1 and 21 of 79 patients (27%) with stage T2 disease. Mobility of the true vocal cords was evaluated by indirect or flexible scope laryngoscopy. There was no information on cord mobility in 1 patient with stage T1 disease. The remaining 21 patients with T1 tumors had normal cord mobility. Vocal cord mobility was impaired in 14 of 79 (18%) patients with T2 cancers.

All patients were treated with megavoltage radiation beams. All patients were scheduled to receive continuous-course RT with either once-daily (54 patients) or twice-daily (47 patients) fractionation. Patients treated with planned split-course RT between 1970 and 1974 were excluded from this analysis as described previously.⁹ Once-daily RT was delivered at 1.7 to 2 Gy per fraction to a total dose of 56.5 to 75 Gy (mean, 66.93 Gy). Twice-daily RT was delivered at 1.2 Gy per fraction with a 4–6 hour interfraction interval to a total dose of 69.6 to 79.2 Gy (mean, 74.72 Gy). A minimum 6-hour interval has been used in recent years.¹⁰ The RT techniques have been described previously.¹¹

A planned unilateral neck dissection was performed after RT for clinically positive nodes in 43 of 101 patients (43%). In recent years, 3 patients received induction chemotherapy that consisted of 2 cycles (2 patients) or 3 cycles (1 patient) of cisplatin and 5-fluorouracil before RT. These patients are included in this "RT alone" series because a recent meta-analysis has shown no significant improvement in the likelihood of tumor control or survival associated with the use of neoadjuvant chemotherapy in this setting.¹²

Control of disease in the pyriform sinus (local control), in the regional lymphatics (control of neck disease), and in the pyriform sinus and neck

nodes (control above the clavicles or locoregional control) was calculated by both direct and actuarial (product limit) methods.^{13,14} For direct calculations, patients who died within 2 years of treatment with the site(s) in question continuously disease-free were excluded from analysis. Three patients who underwent laryngectomy for chondronecrosis or suspected tumor with no evidence of tumor in the laryngectomy specimen were excluded from the direct calculation of local control but were included in the actuarial calculation and were censored at the time of the laryngectomy. Patients were considered to be successfully salvaged after an operation for tumor recurrence in the pyriform sinus and/or neck if they remained alive and continuously disease-free at the site(s) in question for at least 1 year after salvage surgery or until death or last follow-up.

The probability of cause-specific survival (CSS) and absolute survival was calculated with the product-limit method. For the calculation of CSS, patients were censored if they died from intercurrent disease. The end point for analysis of overall survival was death from any cause.

Exact test procedures were used to calculate significance levels between proportions.¹⁵ Significance levels between curves were determined by the log-rank test.^{14,16} Multivariate analyses of prognostic variables was performed with the forward stepwise log-rank tests of association of covariates.^{14,17}

RESULTS

Time to Recurrence. Forty patients (40%) had tumor recurrence develop in the pyriform sinus, neck, and/or distant sites. Recurrence developed within 2 and 5 years of RT in 93% and 100% of patients, respectively. All primary site recurrences were seen within 2 years of RT.

Local Control. Direct calculation of control of disease in the pyriform sinus is shown in Table 1. Local recurrence after RT was low for both stage T1 and T2 tumors. Salvage surgery with total laryngectomy and partial pharyngectomy was attempted in about half of the patients (57%) who had local recurrence develop. When attempted, surgical salvage for local tumor recurrence was successful in 7 of 8 patients (88%). Actuarial rates of initial local control (after RT) and ultimate local control (including patients successfully salvaged after a local recurrence) are shown in Figure 1.

End points for univariate and multivariate

Table 1. Local control (no. controlled/no. treated).

Stage	Excluded*	Local control after RT ± ND (%)	No. salvaged/no. attempted	Ultimate local control (%)
T1	3	17/19 (89)	1/1	18/19 (95)
T2	12	55/67 (82)	6/7	61/67 (91)

*Twelve patients died of intercurrent disease <2 y after RT with the primary site continuously controlled, and three patients had a total laryngectomy for complications or suspected recurrence with a pathologically negative specimen.

Abbreviations: ND, neck dissection; RT, radiotherapy.

analysis included local tumor control with larynx preservation, CSS, absolute survival, and treatment-related complications. Univariate and multivariate analyses were used to evaluate the influence of the following variables on the likelihood of local control: stage (T, N, and overall), vocal cord mobility, pyriform sinus apex involvement, radiation dose, fractionation schedule (once vs twice daily), and overall treatment time.

Univariate analysis of factors that might influence local tumor control after RT is presented in Table 2. The only factor that reached statistical significance at the $p < .05$ level was tumor extension to the apex of the pyriform sinus in patients with stage T1 disease (100% local control without apex involvement). For patients with stage T2 tumors, the chance of local control was 16 percentage points higher with twice-daily fractionation with a level approaching statistical significance. Univariate analysis with stage T1 and T2 patients combined, as well as multivariate analysis (variables described in the methods section above), did not identify any variables that significantly influenced the probability of local control with a significance level of $p < .1$ (data not shown).

Local Control with Larynx Preservation. Local control with larynx preservation (no exclusions) was obtained in 19 of 22 (86%) patients with T1 cancers and in 65 of 79 (82%) patients with T2 lesions. The actuarial rates of local control with larynx preservation are shown in Figure 2. The goal of this analysis is to evaluate the ability of RT to eradicate tumor in the pyriform sinus without damaging the larynx to the extent that the patient cannot effectively communicate with laryngeal speech. As discussed in the "Complications" section following, some patients had laryngeal edema develop, requiring tracheostomy tube placement. Such patients retained their larynx

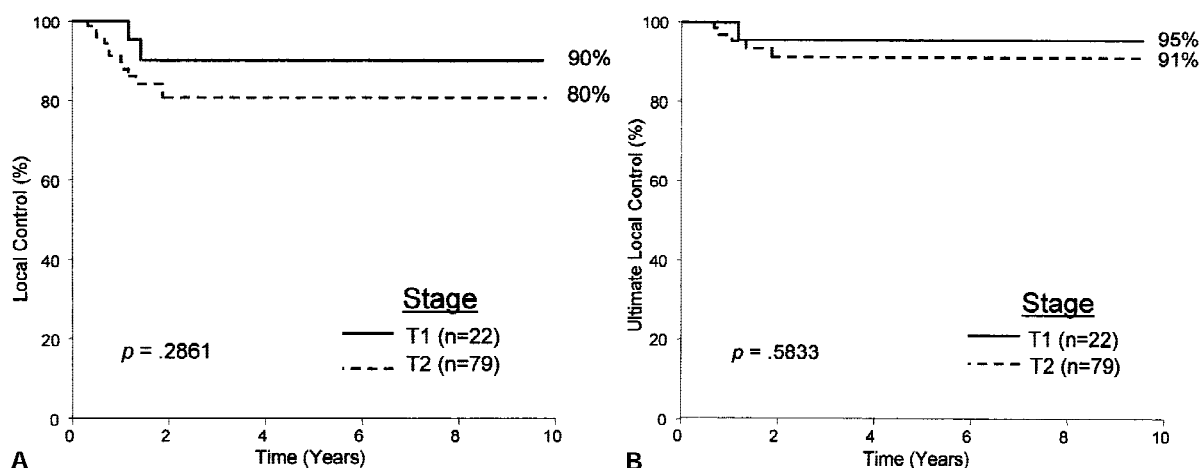


FIGURE 1. Actuarial rates of initial (A) ($p > .1$), and ultimate (B) ($p > .1$) local control after treatment. Five-year values were as follows: initial control—stage T1, 90%; stage T2, 80%; ultimate control—stage T1, 95%; stage T2, 91%.

but clearly had problems with laryngeal speech. Because we did not formally evaluate the quality of laryngeal speech, the analysis of voice preservation is performed with the surrogate end point of local tumor control in a patient who has not undergone total laryngectomy. The only differ-

ence between the calculation of local control as opposed to local control with larynx preservation is the 3 patients who underwent total laryngectomy for suspected tumor or chondronecrosis with no evidence of tumor in the specimen.

Locoregional Control. Direct and actuarial calculations of locoregional control (control of the primary lesion and neck nodes) are shown in Table 3 and Figure 3. The likelihood of tumor control drops markedly for patients with stage III or IV disease. Most recurrences in stage III patients were successfully salvaged as opposed to stage IV patients, in whom ultimate control above the clavicles was only 66%.

Distant Metastasis. Distant metastasis was present at the time of initial detection of recurrent tumor in 20 of the 40 patients (50%) who had

Table 2. Pyriform sinus carcinoma: local control after radiotherapy.			
(No. controlled/no. treated*)			
Stage	Parameter	Local control (%)	p Value†
T1	Vocal cord mobility		
	Normal	16/18 (89)	
	Impaired	0/0	1.000
	No data	1/1 (100)	
T1	Apex involvement		
	Uninvolved	14/14 (100)	
	Involved	1/3 (33)	0.0221
	No data	2/2 (100)	
T1	Fractionation		
	Once daily	12/13 (92)	
	Twice daily	5/6 (83)	0.5439
T2	Vocal cord mobility		
	Normal	46/55 (84)	
	Impaired	9/12 (75)	0.3655
	No data	0/0	
T2	Apex involvement		
	Uninvolved	37/45 (82)	
	Involved	15/18 (83)	0.6155
	No data	3/4	
T2	Fractionation		
	Once daily	22/30 (73)	
	Twice daily	33/37 (89)	0.0865

*Excludes 12 patients who died of intercurrent disease <2 y after radiotherapy with primary tumors continuously controlled and 3 patients who had a total laryngectomy with a negative specimen for tumor.

†Significance levels do not account for the small subsets of patients for whom no data were available.

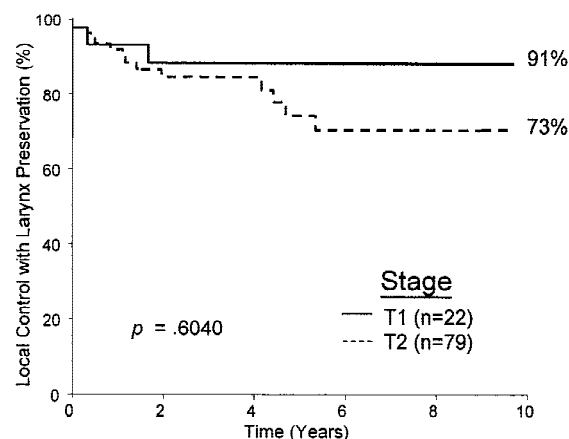


FIGURE 2. Local control with larynx preservation ($p > .1$). Five-year rates were 91% for T1 cancers and 77% for T2 lesions.

Table 3. Control above the clavicles (no. controlled/ no. treated).

Stage	Excluded*	Control after RT \pm ND (%)	No. salvaged/ no. attempted	Ultimate control (%)
I	1	6/6 (100)	0/0	6/6 (100)
II	4	12/14 (86)	1/1	13/14 (93)
III	2	10/18 (56)	5/6	15/18 (83)
IVA	9	22/35 (63)	1/1	23/35 (66)
IVB	1	6/11 (55)	1/1	7/11 (64)

Abbreviations: ND, neck dissection; RT, radiotherapy.

*Died within 2 y of treatment with the primary site and neck continuously disease-free.

recurrent disease develop. The lung was the most common site of distant metastasis (14 of 20 patients, 70%). The actuarial rate of freedom from distant metastasis is shown in Figure 4.

Survival. CSS and overall survival rates are shown in Figure 5.

Complications. Late complications related to RT and/or salvage surgery were seen in 12 of 101 patients (12%). Three patients (3%) died as a result of complications that could be related to RT. The complication rate was similar for patients treated with once-daily vs twice-daily RT. There was no clear relationship between radiation dose and late complications (data not shown). The 3 patients who received neoadjuvant chemotherapy did not experience late complications. Late complications observed in this series included the following:

- Total laryngectomy was performed in 3 patients with no evidence of tumor in the specimen: 1 laryngectomy was done because of clinical signs of recurrence, and 2 were done for chondronecrosis precipitated by biopsy. Wound complications developed after laryngectomy (flap reconstruction) in all 3 patients: 2 cases of wound dehiscence and fistula requiring a second surgical procedure to correct (RT: 70 and 75 Gy, both once-daily fractionation), 1 case of fatal carotid blowout (RT: 65 Gy once-daily fractionation).
- One patient died of carotid blowout immediately after total laryngectomy and partial pharyngectomy for local recurrence. This patient received 65 Gy once-daily RT.
- Five patients required a permanent gastrostomy tube after RT. One of these patients also required a permanent tracheostomy tube and another required a temporary tracheostomy tube for 1 year.

- One patient had an esophageal stricture develop, resulting in a 40-lb weight loss 8 years after 74.4 Gy twice-daily RT. The stricture responded well to endoscopic dilation without additional complications for the remainder of the patient's life (2 additional years).
- One patient was unable to swallow after RT to the point that the patient was maintained on chronic hyperalimentation until death of intercurrent disease 2.5 years after 70 Gy once-daily RT.
- One patient died of a myocardial infarction immediately after neck dissection done in an attempt to treat an isolated neck recurrence 2 years after RT.

DISCUSSION

There is no randomized trial comparing conservation surgery and RT for T1-T2 pyriform sinus carcinoma. Therefore, to assess the effectiveness of RT alone or in combination with a neck dissection for early stage pyriform sinus cancer, it is necessary to compare our data with those reported in the literature. This sort of comparison is subject to the various biases inherent in the evaluation of any nonrandomized data and is influenced by factors such as referral patterns, staging, and the method of data analysis. The two major staging systems used in the literature are those outlined by the AJCC and the UICC (International Union Against Cancer); the definitions of T1 and T2 lesions in these systems are similar.^{18,19} In contrast, the Washington University staging system proposed by Sessions and Ogura,²⁰ which was used to report their data on low-dose preoperative RT and partial laryngopharyngectomy, differs markedly from the AJCC and UICC systems.^{20,21} Sessions and Ogura²⁰ defined T stages as follows: T1, one site involved; T2, two sites involved; T3, three sites involved; and T4, tumor extension outside the inferior hypopharynx. Because fixation of the larynx is not a factor in the Washington University staging system, a T3 or T4 lesion according to their system could be classified as a T2 lesion in the AJCC or UICC systems. Clearly, a stage-for-stage comparison of data classified according to the Washington University system with data classified by the AJCC or UICC systems could result in misleading conclusions.

Proportion of Patients Suitable for Conservative Therapy. Most patients with squamous cell carcinoma of the pyriform sinus have locally advanced disease and are best treated with com-

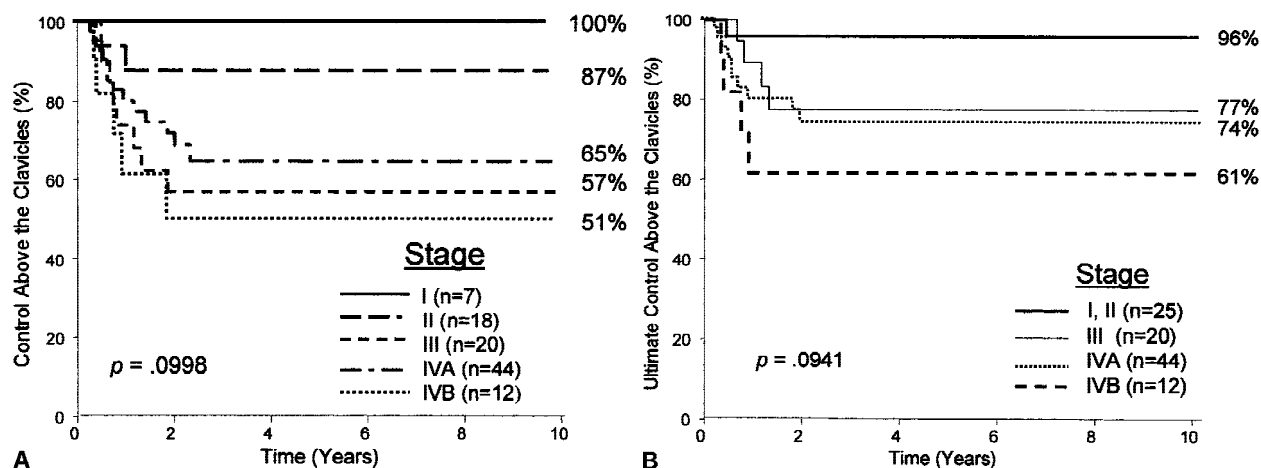


FIGURE 3. Actuarial rates of initial (A) ($p > .1$), and ultimate (B) ($p > .1$) locoregional control above the clavicles. Five-year rates were as follows: Initial control—stage I, 100%; stage II, 87%; stage III, 57%; stage IVA, 65%; stage IVB, 51%; ultimate control—stage I-II, 96%; stage III, 77%; stage IVA, 74%; and stage IVB, 61%.

combined total laryngectomy and total or partial pharyngectomy plus RT.²² Sessions and Ogura²⁰ outlined the following criteria for a partial laryngopharyngectomy: true vocal cords and arytenoids uninvolved by tumor, cords normally mobile, apex of the pyriform sinus free of tumor, no evidence of cartilage invasion, and no tumor extension to the postcricoid area. Patients with poor pulmonary function are not candidates for partial laryngopharyngectomy. Tumors suitable for conservation surgery would be classified as T1 or favorable T2 lesions according to the AJCC or UICC staging systems. Some patients who would not be suitable for conservation surgery because of anatomic extension (eg, to the apex or arytenoid) or medical illness are suitable for treatment with irradiation.^{23,24} Probably 30% to 50% of patients have lesions that are suitable for laryngeal conservation surgery or irradiation alone. The fraction of patients who are offered conservation therapy is highly dependent on the surgeon and/or the radiation oncologist treating the patient and, therefore, varies from one institution to another.

Freeman et al²¹ reported a series of 175 patients treated at Washington University for squamous cell carcinoma of the pyriform sinus between 1964 and 1973. Eighty-five patients (49%) underwent low-dose preoperative RT followed by partial laryngopharyngectomy and neck dissection. Similarly, Dubois et al²⁵ reported a series of 363 patients treated for pyriform sinus cancer in Montpellier, France, between 1966 and 1980; 49 (32%) of 154 patients who were treated with combined RT and surgery underwent a conservation

operation sparing at least part of the larynx, whereas 61 (29%) of 209 patients treated with external irradiation alone had UICC T1 and T2 tumors that also would have presumably been suitable for conservation surgery. At the University of Florida, T1 and favorable T2 pyriform sinus cancers are usually treated with RT. In a series of 155 patients treated between 1962 and 1984, 50 patients (32%) with T1 and T2 lesions received larynx-sparing treatment; three underwent partial laryngopharyngectomy, and 47 were treated with RT.²³ In some institutions, all or almost all of the patients have been treated with operations that included total laryngectomy.^{26–28}

Another option is transoral laser excision, which would often be combined with postopera-

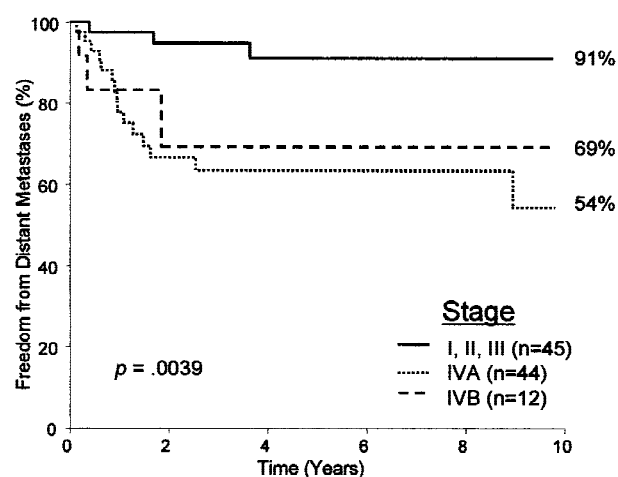


FIGURE 4. Actuarial likelihood of freedom from distant metastasis ($p = .004$). Five-year rates were as follows: stage I-II, 96%; stage III, 86%; stage IVA, 63%; and stage IVB, 69%.

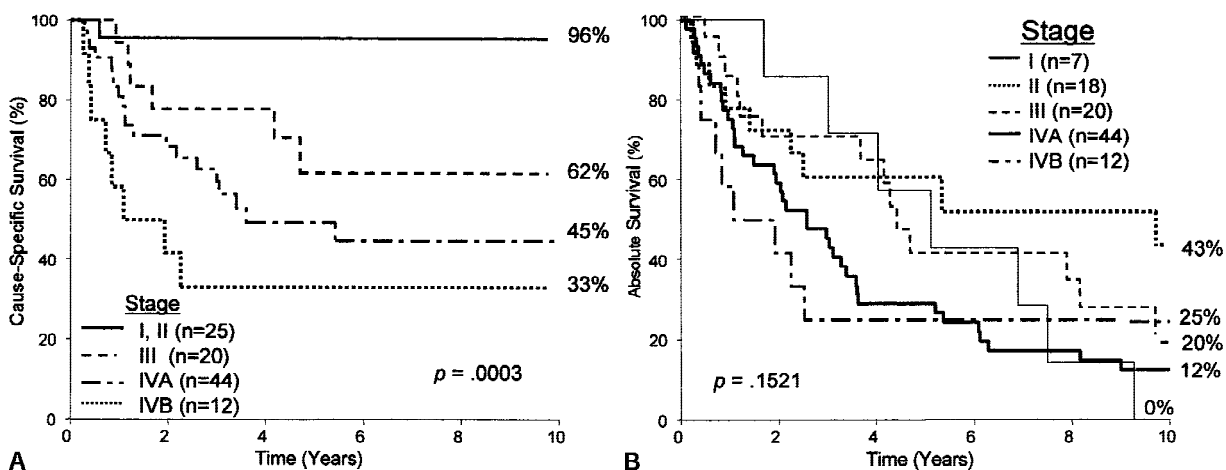


FIGURE 5. Actuarial cause-specific survival (**A**) ($p = .0003$), and overall survival (**B**) ($p > .1$). Five-year survival rates were as follows: cause-specific survival—stage I-II, 96%; stage III, 62%; stage IVA, 49%; stage IVB, 33%; overall survival—stage I, 57%; stage II, 61%; stage III, 41%; stage IVA, 29%; stage IVB, 25%.

tive RT. The criteria for transoral laser excision are not well defined, and data supporting this treatment are limited.

Local Control. Marks et al²⁹ reported local control in 70 (88%) of 80 patients treated with low-dose preoperative RT and partial pharyngolaryngectomy at Washington University. Vandembrouck et al²⁸ reported local control in 16 (89%) of 18 patients (UICC T1, 17 patients; T2, 1 patient) treated with conservation surgery at the Institut Gustave-Roussy. Laccourreye et al³⁰ reported on a series of 34 selected patients with T2 pyriform sinus carcinoma who underwent a supracricoid hemilaryngopharyngectomy at the Hôpital Laennec; patients had follow-up for ≥ 6 years. One patient had a local recurrence develop; the 5-year local control rate was 97%.

Batani et al³¹ achieved local control in 61 (68%) of 90 patients with UICC T1 and T2 squamous cell carcinomas of the pyriform sinus after RT alone at the Institut Curie. Dubois et al²⁵ controlled 44 (73%) of 60 T1 and T2 cancers with RT alone. The overall local control rate after irradiation alone at the University of Florida for T1-T2 lesions was 87% (86 of 101). The rates of local control after RT or conservation surgery are similar for early-stage lesions. The small reported differences are likely due to inclusion of some patients with less favorable lesions (particularly patients with involvement of the apex of the pyriform sinus) in irradiation series. Specifically, patients in the Institut Curie series³¹ were “unselected” and thus include patients with less favorable T2 tumors. Similarly, Dubois et al²⁵ ex-

plained that they tended to use primary radiotherapy for patients with advanced or otherwise unfavorable tumors. The likelihood of local control after radiation therapy is probably related to tumor volume and (possibly to a lesser extent) involvement of the apex as determined by pretreatment CT or MRI.³²

Voice Preservation. Voice rehabilitation after total laryngectomy may be accomplished by a voice prosthesis (eg, Blom-Singer prosthesis or Panje button), electrolarynx, or esophageal speech. Esophageal speech is difficult to master and is used by only a very small percentage of patients after laryngectomy. Wetmore et al³³ reported that only 60% of patients used a voice prosthesis long term (ie, 2 years or more after surgery). The remainder were rehabilitated with a device, such as an electrolarynx, or were not rehabilitated at all. St Guily et al³⁴ reported the results of voice restoration in 81 patients who underwent a total laryngectomy between 1985 and 1990 at the Tenon Hospital in Paris; 21 patients (26%) underwent no voice restoration.

Freeman et al²¹ reported 85 patients treated with low-dose preoperative RT and partial laryngopharyngectomy at Washington University between 1964 and 1973; laryngeal voice preservation was achieved in 44 patients (52%). The reasons for voice loss were completion laryngectomy (6 patients), tracheostomy for complications (2 patients), death from tumor (23 patients), and postoperative death (10 patients). It is not possible to definitively calculate the rate of tumor control with larynx preservation from the data

presented. However, in some of the 23 patients who died of tumor recurrence (site unspecified), the disease was locally controlled; thus, the rate of local control with larynx preservation may be similar to that observed after RT. Laccourreye et al³⁰ reported laryngeal voice preservation in 32 of 34 patients who underwent a supracricoid hemilaryngopharyngectomy. The overall rate of local control with voice preservation in our series after RT alone was 83% (84 of 101 patients).

Survival. Marks et al²⁹ observed a 59% survival rate at 5 years for 80 patients treated with low-dose preoperative RT and partial laryngopharyngectomy at Washington University between 1964 and 1974. Goepfert et al³⁵ reported a series of 19 patients with carcinoma of the hypopharyngeal wall and pyriform sinus treated with conservation surgery and adjuvant irradiation at the M. D. Anderson Hospital; the authors noted that 32% of the patients were alive and disease-free at a median of 36 months. Vandenbrouck et al²⁸ reported a 5-year survival rate of 39% for 18 patients who underwent a conservative operation at the Institut Gustave-Roussy. Laccourreye and colleagues³⁰ observed a 56% 5-year survival rate in 34 patients with T2 cancers treated with conservation surgery.

Bataini et al³¹ reported the following absolute and cause-specific 5-year survival rates for 90 patients with T1 and T2 pyriform sinus cancers treated with RT alone at the Institut Curie: T1, 21% and 49%; and T2, 28% and 48%. Vandenbrouck et al²⁸ observed a 40% survival rate at 5 years for 31 patients with favorable early lesions selected for treatment with RT alone. The overall absolute and CSS rates at 5 years for patients treated with irradiation alone at the University of Florida were 38% and 60%, respectively.

The likelihood of survival after treatment for T1 and T2 pyriform sinus cancer is influenced more by the extent and location of positive neck nodes than by whether the primary lesion is treated with conservation surgery or RT.³⁶ On the basis of the data reviewed previously, the probability of long-term survival seems to be similar after either treatment option.

Complications. Freeman et al²¹ reported 12% fatal postoperative complications and 19% nonfatal complications in 85 patients undergoing low-dose preoperative irradiation and partial laryngopharyngectomy at Washington University. The most

common fatal complication was pneumonia. The nonfatal complications included pharyngocutaneous fistulae (5 patients), aspiration pneumonia (5 patients), vocal cord paralysis necessitating a permanent tracheostomy (2 patients), esophageal stricture (1 patient), hemorrhage (1 patient), wound infection (1 patient), and chyle fistula (1 patient). The authors noted that the incidence of complications was higher than that observed after partial laryngectomy for primary lesions of the glottic or supraglottic larynx. Goepfert et al³⁵ reported that 2 (11%) of 19 patients undergoing conservation surgery for cancers of the hypopharyngeal wall and pyriform sinus had persistent aspiration and fatal pulmonary complications. Vandenbrouck et al²⁸ observed that 2 of 18 patients undergoing a conservative operation required permanent tracheostomies. Laccourreye et al³⁰ observed no fatal postoperative complications in 34 patients treated with conservation surgery alone or combined with adjuvant RT or chemotherapy. Completion laryngectomy was performed in 2 patients (6%) because of persistent aspiration, and 1 patient died of chondronecrosis.

Bataini et al³¹ reported that 11 (2.5%) of 434 patients treated with irradiation alone for pyriform sinus carcinoma experienced fatal treatment complications; 90 patients had UICC T1 and T2 lesions, and the remainder had T3 cancers. The authors reported that 11% of 114 patients alive at 3 years had major nonfatal complications. Overall, 12 of 101 patients (12%) treated at the University of Florida experienced significant late complications resulting from RT.

Although the incidence of severe complications after partial laryngopharyngectomy or RT alone is significant, the risk of fatal complications is greater after conservation surgery.³⁷ The partial resection of the pharyngeal wall, in addition to a supraglottic laryngectomy, results in more frequent episodes of aspiration compared with supraglottic laryngectomy.

Adjuvant Chemotherapy. Randomized trials indicate that induction chemotherapy may be used to select patients with advanced cancers of the larynx³⁸⁻⁴⁰ or pyriform sinus. Concomitant chemotherapy and RT may result in improved locoregional control and survival compared with RT alone for patients with advanced head and neck cancer.^{12,41}

CONCLUSIONS

Radiotherapy alone or combined with a planned neck dissection results in local control and survival rates that are similar to those observed after conservation surgery, with a lower risk of severe complications. Patients with a clinically negative neck and those with low-volume positive neck nodes have a high probability of cure with RT, and adjuvant chemotherapy is unnecessary.

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