Preradiotherapy Computed Tomography as a Predictor for Local Control in Supraglottic Carcinoma

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Introduction
Successful treatment of supraglottic carcinoma can be achieved with either surgery or radiotherapy. Historically, patients with small tumors (T1, T2 and early T3) who were felt to be reliable for close follow-up were offered radiotherapy. Patients often choose radiotherapy over surgery because laryngeal function (speech) is preserved with the former. However, tumor recurrence after radiation occurs in 10-35% of patients, and while salvage surgery is possible, it carries a high complication rate.

At the University of Florida, analysis of local control and larynx preservation by tumor size (comparing tumors >6cm³ vs. < 6cm³) revealed that larger tumors were significantly less likely to be successfully controlled by radiotherapy. This report updates that analysis and examines whether or not extension into the pre-epiglottic space impacts on local control following definitive radiotherapy.

Methods
This study examined sixty-three patients with squamous cell carcinoma of the supraglottic larynx who were treated with definitive radiotherapy between 1982 and 1991 at the University of Florida. Patients with spread of cancer outside the larynx or into the thyroid cartilage were excluded. Ninety-five percent of the 63 tumors were either stage T2 or T3 according to the American Joint Committee on Cancer 1983 staging system. Radiation was delivered either daily or twice daily to a total dose ranging from 65Gy to 74.4Gy. Selected patients underwent a neck dissection following radiotherapy.

All patients underwent pre-treatment, contrast-enhanced computed tomography of the neck, and all scans were retrospectively reviewed by two head and neck radiologists. Tumors were outlined on each image and tumor volumes in cubic centimeters were calculated. Pre-epiglottic spacespread was estimated and expressed as < 25%, 25%-75% or >75% of the pre-epiglottic space.

Results
Overall, sixteen of the 63 patients (25%) had disease recur at the primary site following definitive radiation. Three additional patients underwent laryngectomy for complications of radiation (laryngeal edema or necrosis). Thus, 70% of all patients had the disease controlled and maintained a functioning larynx.

Eighty-nine percent of patients with tumors less than 6cm³ had local control and laryngeal preservation compared to 40% for tumors greater than 6cm³. No patient with a tumor less than 6cm³ developed a complication requiring laryngectomy in contrast to three patients with tumors greater than 6cm³. Comparing rates of laryngeal preservation by tumor stage and size revealed that stage T3 tumors larger than 6cm³ had significantly worse rates of both local control and larynx preservation compared to T1, T2 and T3 tumors less than 6cm³.

The amount of the pre-epiglottic space invasion did not affect local control. However, patients with greater than 25% of the pre-epiglottic space involved by tumor had lower larynx preservation rates compared to the cohort of patients with less than 25% of the pre-epiglottic space invaded. Specifically, three patients with greater than 25% of the pre-epiglottic space involved had their tumors controlled by radiation but needed laryngectomy secondary to radiation complications. This result is statistically significant when compared to the number of patients (zero) with less than 25% of the pre-epiglottic space involved who had their tumor controlled but necessitated a laryngectomy.

Conclusion
The chance of local control following definitive treatment with radiotherapy was related to both tumor stage and volume but not
the extent of pre-epiglottic space invasion. The degree of pre-epiglottic space invasion, however, did impact on the likelihood of maintaining a functioning larynx.

The results of this study are being utilized at the University of Florida to appropriately counsel patients regarding the risk of tumor recurrence after definitive radiation, to offer alternative treatments to patients with bulky tumors, and to guide post-radiotherapy follow-up. Specifically, patients with high volume tumors and who are medically fit for surgery are informed that organ preservation surgery may offer superior rates of larynx preservation than radiotherapy. Another alternative treatment strategy is neoadjuvant chemotherapy. Patients with tumors that would require a total laryngectomy are offered chemotherapy and those with greater than 50% reduction in tumor size are treated with combined chemotherapy and hyperfractionated radiotherapy (the total prescribed dose is given over a course of smaller divided doses, called fractions). Hyperfractionation usually involves the delivery of radiation twice a day, as early as possible in the day and then late in the afternoon). The authors conclude that the results reported here will lead to more informed decisions, optimizing patient care.