Increased Pharyngeal Reflux in Patients Treated for Laryngeal Cancer: A Pilot Study

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Abstract
Objective. Laryngopharyngeal reflux may cause significant morbidity in the head and neck cancer population. The goal was to determine if pharyngeal reflux is increased as a result of treatment for laryngeal cancer.
Study Design. A prospective clinical trial.
Setting. Tertiary care center.
Subjects. Head and neck cancer patients treated at LSU Health–Shreveport with a plan for total laryngectomy.
Methods. Pharyngeal pH probes with resultant reflux scores were utilized in patients with laryngeal/pharyngeal cancer with a plan for total laryngectomy.
Results. Twenty-four patients were enrolled, of whom 10 underwent postlaryngectomy pH probe monitoring. The mean upright Ryan score for patients with prior radiotherapy was 238.4 (n = 8), compared with 22.0 (n = 16) in those without prior radiotherapy (P = .02). The supine score was 12.7 in the radiotherapy group and 2.7 in those without radiotherapy (P = .12). For those who completed the postlaryngectomy pH study (n = 10), the mean preoperative upright Ryan score was 106.32 ± 279.1 versus a postoperative score of 209.0 ± 352.6 (P = .04). The mean supine preoperative Ryan score in this group was 3.9 ± 3.47, as opposed to 8.1 ± 9.6 postoperatively (P = .13)
Conclusions. This study suggests that treatment of laryngeal cancer may increase the incidence of pharyngeal reflux. Consider screening for reflux in patients previously treated for laryngeal cancer.

Keywords
laryngopharyngeal reflux, total laryngectomy

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Laryngopharyngeal reflux (LPR) has been linked to a variety of otolaryngologic disorders, including dysphonia, dysphagia, globus pharyngeus, laryngitis, granulomas, as well as subglottic stenosis. There is also evidence that it may play a role in the etiology of upper aerodigestive carcinoma, although this is debated.1,2

It has been suggested that the laryngectomy patient population may have a high incidence of gastropharyngeal reflux.3 However, no prospective clinical trial has been performed on this population to test the hypothesis that laryngectomy increases reflux. Reflux may contribute to significant morbidity in this group, as it has been demonstrated that reflux can cause tracheoesophageal puncture failure.4,5 In addition, Seikaly and Park reported an increased incidence of pharyngocutaneous fistula with uncontrolled gastroesophageal reflux.6 Total laryngectomy (TL) patients who have undergone radiotherapy frequently experience xerostomia, leading to decreased neutralizing ability of saliva. Korsten et al found that clearance of acid from the esophagus and 24-hour intraesophageal pH were markedly abnormal in patients with xerostomia.7 A laryngectomy significantly alters the anatomy of the pharynx, and a cricopharyngeal (CP) myotomy is often performed concomitantly. It was demonstrated that CP myotomy and interruption of the pharyngeal plexus may produce not only dysfunction of the upper esophageal sphincter but also alteration of peristalsis of the proximal esophageal body.8 Alterations of the gastrointestinal protective mechanisms, including the upper esophageal sphincter and pharyngo–upper esophageal contractile reflex, may contribute to increased pharyngeal reflux. We sought to determine if patients treated for laryngeal/pharyngeal cancer with a plan for laryngectomy demonstrated posttreatment increase in reflux. We performed preand postoperative 24-hour pharyngeal pH probe monitoring using the Restech Dx-pH 24-hour pH probe (Respiratory Technology Corporation, San Diego, California).

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Methods

Twenty-four patients with head and neck cancer (laryngeal or hypopharyngeal), treated at LSU Health–Shreveport, were enrolled. Patients had either failed previous radiotherapy ± chemotherapy or were newly diagnosed cancer patients. The primary goal was to obtain pH studies in all patients with laryngeal cancer to determine how its treatment effects pharyngeal reflux. If the patients were on antireflux medication regimens, they were asked to withhold the medication for 2 weeks prior to the pH study. LSU Health Institutional Review Board approval was obtained.

All 24 patients underwent the 24-hour pH probe prior to surgery. Of these 24 patients, 8 had received prior radiotherapy, and 16 were newly diagnosed laryngeal cancers. Three patients from the radiation failure group did not undergo a TL. Two were deemed unresectable, and 1 patient underwent a partial laryngectomy. Of the remaining 21 patients, 10 underwent further postlaryngectomy 24-hour pH study. Of these 10 patients, 4 underwent adjuvant chemoradiation after surgery and before the postoperative pH study was completed. Five patients had previously failed radiation and had no further treatment between the laryngectomy and the postoperative pH study. One patient had primary surgical therapy without any adjuvant therapy. The mean number of days from the laryngectomy to the postoperative pH study was 172.

A Restech Dx-pH 24-hour pharyngeal probe was used in all cases. Restech provided the pH probes that we used in the study. The probe is placed transnasally, with the sensor at the junction of the nasopharynx and oropharynx. The pH studies were analyzed with the Restech Dx Lite software (Respiratory Technology Corporation). Variables recorded included number of upright reflux events (as defined by drop in pharyngeal pH < 5.5), number of supine reflux events (defined by drop in pharyngeal pH < 5.5), total time below baseline supine, total time below baseline upright, percentage of time below baseline supine, and percentage of time below baseline upright. The aforementioned data were compiled with the system software to calculate a composite Ryan score, the measured test variable.

The Wilcoxon rank-sum test was used to determine if radiotherapy and other categorical factors are significantly associated with LPR, and the Spearman rank correlation analysis was used to determine numerical factors significantly associated with LPR. Among the 10 patients who completed the second pH probe study after undergoing TL surgery, the Wilcoxon signed-rank test was used to determine significant increase in both upright and supine Ryan scores.

Results

All 24 patients—8 with prior radiation and 16 without radiation—completed the prelaryngectomy pH testing. The average patient age was 61.2 years (range, 39-84). A majority of the patients were white men with stage 4 cancer. Of the 21 patients who underwent TL, 18 (85.7%) had a concurrent CP myotomy (Table 1).

Patients who had prior radiation (n = 8) had a significantly higher average preoperative Ryan upright score of 238.4, compared with 22.0 (P = .02) in those without radiation therapy (n = 16). The supine Ryan score was 12.7 in those with radiation therapy and 2.7 in those without (P = .02; Table 2). Of the 24 patients with pH studies, 21 then had laryngectomies, and 10 of these agreed to have postlaryngectomy pH probe studies. Four of these patients underwent adjuvant chemoradiation, and 5 had surgical salvage. Interestingly, even in this small sample size (n = 10), it can be seen from Table 3 that the post-TL Ryan scores are significantly higher than their corresponding pre-TL scores. The upright Ryan score increased from 106.32 ± 729.1 to 209.0 ± 352.6 (P = .04).

Discussion

Gastric fluids have been shown to cause severe damage to the upper airway mucosa in animal models. In the laryngectomy population, this may lead to difficulty with voicing, increased incidence of pharyngocutaneous fistula, and increased incidence of mucositis during radiotherapy. Pattani et al demonstrated that 68% of patients with TL and voice restoration with tracheoesophageal puncture with subsequent aphonia had return of voice after empiric treatment with reflux therapy. Boscolo-Rizzo et al found that the presence of reflux reduced the functional lifetime of the prosthesis by half. Our results demonstrated that the group of patients with prior head and neck radiation therapy had higher reflux scores than those without, supporting Korsten et al’s conclusion that xerostomia leads to increased esophageal acid exposure. It has been
Our results showed that both upright and supine Ryan scores increased after treatment of laryngeal cancer, suggesting that the treatment may be a risk factor for pharyngeal reflux. This could be explained by the significant alteration in the anatomy of the lower pharynx, with loss of protective mechanisms. Hoppo et al found that a position alteration in the anatomy of the lower pharynx, with loss of protective mechanisms. This could be explained by the significant advantage of sensing gaseous acidity in the pharynx, which may otherwise be missed with conventional esophageal liquid sensors. Certainly, nasal and pharyngeal airflow after laryngectomy is altered; however, the pharyngeal sensor has been shown to improve patient tolerability as compared with dual pH probe sensors and to reliably document LPR events when compared with the gold standard dual probe.10,11

Based on our findings, treatment of laryngeal cancer with a laryngectomy ± adjuvant therapy may be a risk factors for pharyngeal reflux.

### Conclusion

This pilot study suggests that treatment of laryngeal cancer with surgery (TL) as well as radiation therapy may be risk factors for pharyngeal reflux. These results should be validated with additional studies; however, given the potential morbidity of reflux and the ease of treatment, consider screening this at-risk patient population.

### Author Contributions

Blake LeBlanc, acquisition/analysis/interpretation of data, drafting/revising article, final approval of the version to be published, accountable for all aspects of work; Ellen Lewis, acquisition/analysis/interpretation of data, revising article, final approval of the version to be published, accountable for all aspects of work; Gloria Caldito, analysis/interpretation of data, revising article, final approval of the version to be published, accountable for all aspects of work; Cherie-Ann O. Nathan, conception and design, acquisition/analysis/interpretation of data, drafting/revising article, final approval of the version to be published, accountable for all aspects of work.

### Disclosures

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### References


