Pharyngeal pH Monitoring in 222 Patients With Suspected Laryngeal Reflux

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To determine the existence of and characterize gastroesophagopharyngeal reflux in patients with symptoms of airway irritation, we monitored pharyngeal pH over a 24-hour period in 222 consecutive patients. Pharyngeal reflux was defined as a drop in pH to less than 4 at the pharyngeal sensor, which occurred simultaneously with acidification of the distal esophagus. Patients were divided into two groups: those with pharyngeal reflux (PR+) and those without (PR−). The Mann-Whitney U test and Student's t test were used to assess intergroup comparisons. Episodes of pharyngeal reflux (range 1 to 36, average 4.4) were identified in 90 PR+ patients (40%). No pharyngeal reflux was identified in the remaining 132 patients (PR−). Episodes of pharyngeal reflux were rapidly cleared (average duration 1.5 minutes), and occurred while in the upright position in 77 (86%) of 90 patients and while in the supine position in 11 (12%) of 90 patients. Twenty-three patients (25%) experienced symptoms in association with an episode of pharyngeal reflux. In the distal esophagus, the percentage of time the pH was below 4 during the upright position and the total percentage of time the pH was below 4 were greater in PR+ patients (6.4% and 5.8%, respectively) when compared to PR− patients (2.6% and 2.6%, respectively). Laryngoscopic findings did not distinguish PR+ from PR− patients. Pharyngeal reflux occurs most commonly in the upright position and can be identified in more than 40% of patients thought to have acid-induced laryngeal symptoms. Even though these episodes are short lived and rapidly cleared, symptoms occur concomitantly in 25% of patients with proven pharyngeal reflux. Patients with laryngeal symptoms and documented pharyngeal reflux have greater amounts of esophageal reflux when compared to patients with laryngeal symptoms and no demonstrable pharyngeal reflux. (J GASTROINTEST SURG 2001; 5:183-191.)

KEY WORDS: GERD, reflux, pH, larynx, pharynx, hoarseness, cough, extraesophageal reflux

Symptoms of chronic cough, hoarseness, and throat clearing are often caused by smoking, voice abuse, and postnasal drip. It has recently been postulated that regurgitation of gastric contents above the upper esophageal sphincter with subsequent spillage into the airway may be an important factor in the genesis of these symptoms. Indirect evidence, such as the presence of abnormal gastroesophageal reflux and improvement of symptoms with acid suppression therapy, supports this etiology of laryngeal injury. For example, the response of laryngeal symptoms to proton pump inhibitor therapy and life-style modification has been reported to be as high as 85% after 12 weeks of therapy in one study. On the other hand, Kibblewhite and Morrison found no difference between placebo and H2 blockers after 2 weeks of therapy in patients with cervical symptoms thought to be related to reflux.

A more accurate, objective method of diagnosing reflux laryngitis would be helpful in directing management and predicting treatment response. Laryngoscopy may reveal erythema, nodularity, ulceration, granuloma, or leukoplakia in patients with pharyngeal reflux, but these changes are not pathognomonic of reflux. Indeed, even in patients suspected of having acid-induced vocal cord nodules, as many as 36% may not have detectable acid exposure in the pharynx. The "gold standard" for identifying and measuring gastroesophageal reflux within the esophagus is
24-hour pH monitoring. Direct monitoring of laryngeal pH to determine the presence of reflux in patients with airway symptoms is impractical. We hypothesized that measuring pharyngeal pH with a system that was similar to that used to measure pH in the esophagus might act as a proxy for laryngeal acid exposure. The ability of a pharyngeal pH sensor to accurately measure acid exposure has been questioned because it may desiccate, which would interfere with pH measurements. Williams et al. in a recent publication, developed specific criteria to help eliminate erroneous data from pharyngeal pH monitoring. These include simultaneous esophageal and pharyngeal acidification, a drop in the pharyngeal pH to less than 4.0, and excluding meals from the period of analysis.

Although some investigators believe that any amount of pharyngeal reflux is abnormal, others have documented occasional pharyngeal reflux in as many as 20% of healthy subjects. To date, the degree of pharyngeal reflux required to initiate laryngeal irritation, the prevalence of pharyngeal reflux in patients with symptoms indicative of laryngeal irritation, and the severity of gastroesophageal reflux in patients with pharyngeal reflux are not well established. The objective of this study was to measure pharyngeal pH in a large number of patients with laryngeal symptoms to identify the following: (1) the frequency with which pharyngeal acid exposure occurred, (2) the characteristics of these episodes, (3) the extent of esophageal reflux in these patients, and (4) the correlation of pharyngeal reflux with laryngoscopic findings.

**MATERIAL AND METHODS**

Ten volunteers underwent pharyngeal pH monitoring with approval from the Human Subjects Review Committee. The volunteers had no esophageal or extraesophageal symptoms of gastroesophageal reflux. These data were used to establish normal values for episodes of pharyngeal reflux.

We studied 222 consecutive patients (136 women and 86 men; mean age 52 years, range 20 to 85 years) clinically suspected of having laryngeal or pulmonary symptoms induced by gastroesophageal reflux. Symptoms and results of esophageal physiologic testing were entered prospectively into the Swallowing Center database. Patients with laryngeal symptoms were evaluated with a full head and neck examination including flexible laryngoscopy and videostroboscopy.

**Symptoms**

Symptoms were rated on a frequency scale ranging from 0 to 4 as follows: 0 = never; 1 = once per month; 2 = once per week; 3 = once per day; and 4 = several times per day. Any frequency that fell between two numbers was upgraded to the higher of the two numbers. Twenty-two symptoms were queried: 11 gastrointestinal (heartburn, regurgitation, abdominal pain, belching, dysphagia to liquids and solids, bloating, nausea, chest pain, odynophagia, globus) and 11 extraesophageal (coughing, hoarseness, wheezing, laryngitis, aspiration, choking, dyspnea, sore throat, asthma, bronchitis, pneumonia).

**Manometry**

A water-perfused eight-channel catheter (four radial ports at the same level and four separated by 5 cm intervals) was used to assess esophageal pressures with the patient in the supine position. The lower esophageal sphincter (LES) was examined with the four radial ports. A station pull-through measurement of the LES pressure determined the characteristics of the sphincter. The LES pressure was averaged over a series of three respiratory cycles. The peristaltic pump of the esophageal body was assessed over a minimum of 10 episodes of deglutition with 5 ml aliquots of water. A single port was used to evaluate the upper esophageal sphincter (UES) location, pressure, and relaxation.

**pH Monitoring**

All acid suppression therapy was stopped 5 to 7 days prior to testing. A four-sensor solid-state pH catheter was placed with the proximal sensor 1.5 to 2.0 cm above the UES as determined by manometry. The remaining three sensors were spaced at 5 cm intervals along the catheter; thus the most distal sensor was always located 13 cm below the UES. pH measurements were sampled every 8 seconds in a recorder (Medtronic, Inc., Minneapolis, Minn.) worn by the patient for a 24-hour period. Symptom diaries were maintained by the patients during the observation period. Data analysis was performed by a software program, which reported events (number and duration of reflux episodes) and calculated acid exposure times over the course of the study. Data collected during and 1 hour after meals were not analyzed because ingested foods have variable effects on acid detection in the pharynx.

A drop in the pH of the pharyngeal sensor was considered a "pharyngeal reflux episode" only if the following occurred: (1) pH dropped below 4; (2) pH fell more than one unit; and (3) the drop in pH was accompanied by a simultaneous drop in the esophageal pH to below 4. Every episode of pharyngeal acidification that met these criteria was considered to be pathologic. Pharyngeal episodes of acidification that