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## **Reflux Laryngitis: What Every Voice Professional Should Know**

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Reflux laryngitis occurs as a result of a backward flow of acid and other stomach contents into the esophagus, to the level of the larynx where contact results in a chemical burn of the lining tissue of the larynx. This backward flow, or reflux, of stomach contents to the larynx and pharynx is referred to as laryngopharyngeal reflux (LPR), which in turn can cause reflux laryngitis as well as reflux pharyngitis, rhinitis, sinusitis, and/or otitis media. Laryngopharyngeal reflux and reflux laryngitis are different entities from gastroesophageal reflux disease (GERD) and esophagitis. In order to understand this distinction fully, it is first necessary to understand the normal mechanisms of swallowing and emptying of the stomach, as both laryngopharyngeal reflux and GERD are disorders of these mechanisms.

### **Normal Swallowing and Gastric Emptying**

The esophagus is the “swallowing tube” that connects the back of the throat (pharynx) to the stomach. The opening to the esophagus sits behind the larynx. (Figure 1) At the top of the esophagus, behind the larynx, there is a ring-like muscle, (the cricopharyngeus muscle or the upper esophageal sphincter) which normally is contracted or closed. This closed state allows air that is inhaled during normal breathing to go into the larynx and lungs instead of into the esophagus and stomach. When swallowing is initiated, the cricopharyngeus muscle relaxes, opening the entrance to the esophagus and allowing food to pass into it. The muscles in the wall of the esophagus contract in a coordinated

fashion to push the food down into the stomach. At the junction of the stomach and esophagus is a sling-shaped ring of muscles (the lower esophageal sphincter) that is normally contracted to help keep the stomach contents in the stomach. When food in the esophagus reaches the lower esophageal sphincter, it relaxes, allowing entrance of the food into the stomach. After the swallow is complete, both the upper and lower esophageal sphincter return to their normal contracted and closed states.

When food reaches the stomach, it stimulates the stomach to release acid. The acid lowers the pH in the stomach. Enzymes from the stomach and pancreas and bile salts from the gallbladder are released into the stomach as well. These enzymes and bile salts help in the digestion of proteins, fats, and carbohydrates. The enzymes that digest proteins are activated in the presence of an acidic environment, which is the reason that the stomach makes acid when food enters. Regardless of what kind of food is eaten, the stomach releases some acid, although certain foods stimulate the release of more acid than do others. In addition to the surge of acid secretion that occurs with eating, the stomach also has a “basal” secretion of acids; that is, there is always a baseline secretion of acid by the stomach, even when empty. The amount of acid secreted increases with meals.

In addition to the secretion of acid and the influx of enzymes and bile salts, the stomach begins to churn when food enters. The churning helps with the digestion of food and it helps to move the food from the stomach into the intestines for further digestion and absorption of nutrients. The stomach is a sac

with two openings, the lower esophageal sphincter and the gastroduodenal junction (the entrance to the intestines). As stomach pressure increases, either with churning or with an increase in external abdominal pressure, the contents of the stomach will flow through the opening with the least amount of resistance. As long as the lower esophageal sphincter has normal tone, this flow is directed into the intestines.

### **What happens during GERD?**

If the lower esophageal sphincter tone is decreased, then it is less effective in blocking the back flow of stomach contents into the esophagus. In such cases, when pressure in the stomach increases, the stomach contents (gastric juice) will flow through the opening of least resistance, which can be back through the lower esophageal sphincter and into the esophagus. If the sphincter has only a slight decrease in its tone, then the amount of gastric juices that is allowed into the esophagus is small, as is the distance it travels up the esophagus. With decreasing levels of tone, more of the gastric juice can flow through the sphincter, and greater increases in stomach pressure can cause reflux across greater distances in the esophagus.

The esophagus is lined with stratified epithelium, which means that the lining of the esophagus is several cell layers thick and serves as a good protective covering for the esophagus against injury, similar to the way in which the skin protects the body from injury. Thus, small amounts of acid in the esophagus may injure the first few layers of lining cells, but will leave many

layers beneath unharmed. As long as at least one cell layer of lining tissue exists undamaged, the individual may not experience symptoms of esophageal injury. If the amount of acid exposure is more severe, more cell layers are injured, and injury deep to the lining tissue may occur, resulting in inflammation or esophagitis, the hallmark of GERD. This type of injury usually produces symptoms of heartburn. GERD that is severe or that goes untreated for prolonged periods of time may result in a change in the lining tissue of the esophagus to a different cell type, a process called metaplasia or Barrett's esophagus. An untreated Barrett's esophagus can eventually become cancer. Thus, everyone with symptoms of heartburn should be evaluated and treated.

### **What happens during Laryngopharyngeal Reflux (LPR)?**

Reflux of gastric juices that travels the full length of the esophagus can reach the upper esophageal sphincter. As long as this sphincter has good tone, reflux will be confined to the esophagus. If the tone in the upper esophageal sphincter is also decreased, then the gastric juices can escape this opening and contact the back of the larynx and the throat (pharynx and hypopharynx). Unlike the esophagus, the larynx is lined by pseudostratified epithelium, which is only one cell layer thick. This lining tissue is, thus, very sensitive to very small amounts of acid; and exposure of the larynx to acid only once or twice a week may be enough to cause a significant degree of injury and inflammation. Thus, although the larynx and esophagus may be exposed to the same amount of acid, if the acid damages one or two cell layers in the esophagus, there are many

more layers to protect the underlying tissue, and no symptoms are produced in the esophagus. If the same amount of acid damages the same number of cell layers in the larynx, the underlying tissue is exposed to the acid and inflammation (laryngitis) ensues. Thus, it is possible to have reflux laryngitis without any esophageal signs or symptoms of GERD, including heartburn. Because GERD may take longer to develop due to the need for prolonged acid exposure before injury occurs in the esophagus, in some people, reflux laryngitis is the earliest symptom of GER.

### **How Do I Know If I Have Laryngopharyngeal Reflux?**

There are many symptoms of reflux laryngitis and laryngopharyngeal reflux, and any one person may have only one symptom or many. Common symptoms of laryngopharyngeal reflux are listed in Table 1. Although heartburn is a common symptom of GERD, it is usually not a symptom of laryngopharyngeal reflux. In fact, many people with laryngopharyngeal reflux may not experience heartburn, and those with heartburn may not experience laryngopharyngeal reflux. Although both GERD and laryngopharyngeal reflux may occur together in one person, it is far more common to experience either one or the other.

### **How is Laryngopharyngeal Reflux Diagnosed?**

Laryngopharyngeal reflux is diagnosed based on a combination of symptoms and findings in the larynx on physical examination. Diagnosis is made

usually by an otolaryngologist, as the larynx needs to be visualized to make the diagnosis. Although gastroenterologists and internists may place an endoscope into the mouth or nose to visualize the esophagus, they are not usually equipped or trained to visualize adequately the larynx and diagnose laryngopharyngeal reflux. The larynx is typically examined by the otolaryngologist with a mirror or with a flexible or rigid laryngoscope. With mirror examination, the patient is seated in a chair, leaning forward with the neck in slight extension and the tongue held out. The mirror is positioned at the back of the mouth and angled down to reflect images of the larynx. The flexible laryngoscope is a small fiberoptic tube with a light at the end that is placed through the nose and positioned above the larynx for direct visualization. The rigid endoscope, often used during videostroboscopy, is a metal telescope with lighted, magnifying reflectors at the end. It is positioned in the mouth similarly to the mirror.

Because the opening to the esophagus sits behind the arytenoids and the back part of the larynx, these areas are affected most by reflux (Figure 2). Typically, the larynx shows signs of contact irritation and inflammation in these regions, as evidenced by the presence of redness (erythema) and swelling (edema) of the arytenoids, interarytenoid region (the area between the arytenoids, also referred to as the posterior glottis, or incorrectly as the posterior commissure), and the post-cricoid region (the tissue behind the arytenoids that separates the larynx from the esophageal opening). In severe cases, the reflux material can contact other parts of the larynx, causing erythema and edema of the vocal folds (Figure 3), the supraglottis (the portion of the larynx above the

vocal folds) (Figure 4), and/or the subglottis (the portion of the larynx below the vocal folds. With chronic, severe acid exposure, the lining tissue of the back of the larynx and/or the vocal folds may begin to produce keratin (the substance in skin that contributes to its tough, resilient nature). This change is often referred to as keratosis or hyperkeratosis and is thought to be a precursor to the development of carcinoma.

Reflux laryngitis is also thought to be at least one of the factors contributing to the development of abnormal muscle use patterns in the larynx (commonly referred to as muscle tension dysphonia or laryngeal hyperfunction); nodules (Figure 5), polyps (Figure 6), and cysts (Figure 5 and 7) of the vocal fold; vocal process granulomas (Figure 8); and vocal process ulcerations. One common theory to explain these associations is that the acid burn from the reflux material in the larynx causes abnormal or decreased sensations in the larynx, similar to the way in which a burn on the finger may cause abnormal sensations there. Some of these sensations may include a throat tickle, a cough, a sensation of fullness or something stuck in the throat, dry mouth, or an altered position sense of the vocal folds. If the position sense of the vocal folds is altered, hyperfunctional voice use patterns may develop from the inability to sense correctly the position of the vocal folds while talking and singing. Usually, this is an unconscious process, and the individual is unaware that the hyperfunctional behavior is developing. Such behavior then causes increased pressure and tension on the vocal folds with phonation and can result in the

development of vocal fold nodules, polyps, cysts, scar, edema, vocal process granulomas, and/or vocal process ulceration.

There are few conditions that cause inflammation of the larynx in the same characteristic pattern as reflux, and laryngeal examination alone is usually sufficient to make a presumptive diagnosis of laryngopharyngeal reflux and reflux laryngitis. In some instances, it is also desirable to evaluate for GERD at the same time, and esophagoscopy may be done concurrently, especially if the patient is 40 years old or had had symptoms for more than five years..

Treatment of reflux laryngitis may begin based on the findings on laryngeal examination and the history. Patients who do not respond well to standard treatment may require further testing, including 24-hour dual probe pH testing, esophageal manometry, esophagoscopy, and/or Barium swallow. Of these studies, 24-hour dual probe pH monitoring and esophageal manometry are the most reliable in the diagnosis of laryngopharyngeal reflux.

### **Esophageal Manometry**

Esophageal manometry is a test in which the resting pressures of the lower esophageal sphincter, the upper esophageal sphincter, and the contractile forces of the esophagus during swallowing are measured. A thin tube with pressure sensors is placed through the nose and into the esophagus, and the position of the lower esophageal sphincter and the upper esophageal sphincter are measured, as well as their resting pressures. In those who are prone to

laryngopharyngeal reflux, both resting pressures may be decreased, implying decreased tone or contraction at rest. The positions of the lower esophageal sphincter and the upper esophageal sphincter are determined during manometry, which allows for the correct positioning of the pH probe sensors for 24-hour pH monitoring. Without measuring their locations via manometry, the sensors can be positioned correctly, rendering the results of pH probe testing inaccurate.

### **Twenty-Four-Hour Dual Probe pH Testing**

The 24-hour pH probe study is a monitoring system that involves the placement of a thin, plastic-coated probe through the nose and into the esophagus. The probe has two sensors on it that detect the presence of acid. One probe lies just above the lower esophageal sphincter, and the other probe sits above the upper esophageal sphincter. The probe is secured to the nose with an adhesive and stays in place for 24 hours. There is a small processor that the patient wears on the belt, like a radio, that records the output of each sensor.

The patient goes home with the probe in place and is asked to resume normal daily activities. The patient is given a diary and is asked to record the activities of the day, such as meals, drinking, sensation of reflux symptoms, exercise, singing, sexual activity, and bedtime. The processor has buttons that the patient can press to record these events when they occur. The probe is removed after 24 hours, and the information is analyzed. The information that can be gained from the 24-hour pH probe monitor includes the number of episodes of reflux into the pharynx and esophagus in the 24-hour period, the

degree of acidity of the reflux material, and the relationship of the reflux episodes to daily activities and to symptoms. This information can help the otolaryngologist tailor the anti-reflux treatment to the patient's specific problem areas. Occasionally, the results of the 24-hour pH probe monitor are not helpful. This occurs if the patient does not happen to have any reflux episodes during the twenty-four hours that the monitor is in place, or if the patient's activities or diet are altered on the day of the study. For singers, actors, and public speakers, it is important to perform while the pH probe is in place, as reflux may occur only during singing and/or oratory speaking and may not be detected otherwise.

### **Esophagoscopy**

Esophagoscopy is the endoscopic evaluation of the esophagus by direct visualization. Esophagoscopy is easily performed most with a small telescope that goes through the nose, with the patient awake and alert. Esophagoscopy can also be performed with telescopes that go through the mouth. However, these usually require sedation or general anesthesia. The purpose of esophagoscopy is to evaluate for the presence of GERD, which may occur in 15-25% of those with laryngopharyngeal reflux. Esophagoscopy will allow for the detection of acid-induced esophageal injuries, such as esophagitis, esophageal ulcers, Barrett's esophagus, and esophageal cancer, and is an important part of the diagnostic protocol in patients with laryngopharyngeal reflux.

## **Barium Swallow**

The barium swallow study is a study in which the patient is given a barium liquid to drink and X-ray pictures and video-recordings are taken of the patient as he or she swallows the barium liquid and is placed in various positions. The barium is seen readily on the X-ray as it travels from the mouth into the pharynx, esophagus, and stomach. If the patient has reflux during the study, it will be seen as regurgitation of the barium from the stomach into the esophagus. If no reflux is seen, then a procedure called barium swallow with water siphonage may be performed. In this procedure, water is swallowed after the routine barium study has been completed. X-ray pictures and video-recordings are taken again during these maneuvers. If reflux of the barium is seen after the water is drunk, then a diagnosis of reflux is made. The barium swallow is most helpful in diagnosing co-existing esophageal abnormalities such as Barrett's esophagitis and hiatal hernia. For these reasons, both the barium swallow and the twenty-four hour pH probe monitoring are performed as complementary studies in some patients.

## **How is Reflux Treated?**

### **Behavioral Modification**

Treatment of reflux laryngitis involves a combination of medical therapy and behavioral changes (Table 2). Any activity that increases intra-abdominal pressure may exacerbate the symptoms of laryngopharyngeal reflux. Such activities may include weight lifting, sit-ups, abdominal crunches, sexual

intercourse, running, dancing, aerobics, public speaking, acting, and singing. To minimize the effects of laryngopharyngeal reflux on the larynx and vocal performance, these activities are best performed on an empty stomach or three to four hours after meals to allow for appropriate gastric emptying. Similarly, one should avoid eating or drinking for at least three to four hours before lying down to sleep. The presence of food in the stomach stimulates the production of acid, making one more prone to reflux while sleeping.

Elevation of the head of the bed so that the entire bed sits at an incline and the head is at least four to eight inches high relative to the feet, also helps to minimize laryngopharyngeal reflux at night while sleeping. In doing so, gravity helps to keep the stomach contents in the stomach; where as, lying flat allows free flow of gastric juices from the stomach into the esophagus and larynx. Sleeping on more than one or two pillows is discouraged, as high elevation of the head alone usually results in a slight flexion of the abdomen, which causes pressure on the stomach throughout the night and predisposes to reflux. If a body wedge is used instead of elevation of the head of bed, then a full body wedge should be used rather than a semi-body wedge, for similar reasons. Elevation of the head of bed can be accomplished most easily by placing wood blocks (2x4's work well), bricks, or phone books stacked between the floor and legs of the bed or between the bed frame and the box spring mattress. (Figure 9) Weight loss of as little as five pounds also can decrease the frequency of reflux episodes because it usually results in less body mass in the abdominal region, thus, decreasing external pressure on the stomach while sleeping.

There are several foods and food products that are known to exacerbate reflux. These are listed in Table 3. Although it is often difficult to eliminate these foods from the diet completely, they should be consumed in moderation. Nicotine and nicotine containing products (including cigarettes, chewing tobacco, pipes, and cigars) also increase reflux and should be avoided. The exact mechanisms by which these food products and nicotine worsen reflux is not completely understood, but it is believed to involve either stimulating increased acid production in the stomach or relaxing the lower esophageal sphincter, and in some cases by doing both.

### **Medical Management of Reflux**

The treatment of reflux consists of both medications and behavioral modifications in the patient's lifestyle. The medications commonly used to treat laryngopharyngeal reflux are proton-pump inhibitors, H<sub>2</sub> –receptor antagonists, and antacids (Table 4). These medications function by decreasing the amount of acid in the stomach; they do not prevent reflux episodes from occurring. By decreasing the amount of acid exposure the larynx experiences from the reflux episodes, they decrease the degree of injury to the larynx from each reflux occurrence. Greater amounts of acid in the larynx cause a greater degree of injury and inflammation. Usually acid suppression is needed continuously over 24 hours, daily to treat laryngopharyngeal reflux and reflux laryngitis. The stomach has a basal acid secretion throughout the day that peaks in the early morning hours during sleep. In addition, surges of acid are produced each time food is

eaten. Although H<sub>2</sub> – receptor antagonists and antacids limit acid somewhat and are available readily over-the-counter, the proton-pump inhibitors (PPI's) clearly have superior acid suppression that provides the amount of coverage needed in those who experience laryngopharyngeal reflux. H<sub>2</sub>-receptor antagonists and antacids just are not strong enough. When proton pump inhibitors are used to treat laryngopharyngeal reflux, they all need to be taken at least twice daily. Even though many of the brands of proton pump inhibitors are marketed as a once-a-day pill, the maximum average duration of acid suppression varies from 14-17 hours, and none has 24-hour acid suppression. Treatment of laryngopharyngeal reflux requires 24-hour acid suppression and twice daily dosing of a proton pump inhibitor, at a minimum. In some patients, even this dose is not enough, and a third or fourth daily dose of proton pump inhibitor or a bedtime dose of an H<sub>2</sub>-receptor antagonist needs to be added. The proton pump inhibitors work best if taken one hour before meals. With a twice-daily dose, this is best accomplished before breakfast and again before dinner in the evening.

Gastric motility agents are used occasionally in the treatment of reflux as well. These agents work by increasing the motility of the gastrointestinal system, which limits the amount of time that gastric contents stay in the stomach, thus limiting the number of reflux episodes. The gastric motility agents that are available currently are used seldom because they have many side effects.

The only way to prevent reflux from occurring is to have surgery to tighten the lower esophageal sphincter, which prevents gastric juices from regurgitating into the esophagus. Few people need the surgery to control the reflux

adequately. Most people do well with a combination of medications and with behavioral modifications. It is believed that much of the injury from reflux is also due to the effects of stomach enzymes, like pepsin, on the laryngeal mucosa. Pepsin becomes more active in an acidic environment, and injury in the larynx from reflux is likely due to a combination of acid and pepsin. By decreasing the amount of acid in the stomach, the activity of pepsin is decreased and the amount of acid exposure the larynx, pharynx, and esophagus experience during a reflux episode is minimized. Some of the laryngeal symptoms may be due to reflex response to irritation of the vagus nerve low in the esophagus which may cause cough, throat clearing or other irritation of the larynx (which is also innervated by branches of the vagus nerve). Acid suppression helps control three problems, as well.

### **Surgical Management of Reflux**

In those in whom twice daily proton pump inhibitor therapy is not sufficient to relieve the symptoms and damage caused by laryngopharyngeal reflux, surgical correction of the lower esophageal sphincter is the treatment of choice. Nissen fundoplication, involves tightening of the lower esophageal sphincter by wrapping a portion of the stomach around the lower end of the esophagus, thus limiting the reflux of stomach contents into the esophagus. This procedure can be performed laparoscopically or open. The laparoscopic approach involves operating through five small incisions in the abdomen with the guidance of

telescopes. The open procedure involves a vertical incision along the abdominal wall and operating with direct visualization.

Other, less invasive procedures to tighten the lower esophageal sphincter by using stitches or radiofrequency ablation through endoscopic approaches, such as the esophageal banding and the Strata procedure, have not yet reached the success rates in GERD patients of Nissen fundoplication in the treatment of reflux. Currently, Nissen fundoplication is the only cure for reflux, with long-term success rates as high as 90 - 95%. For professional voice users undergoing the Nissen procedure, the laparoscopic approach is preferred, as it avoids transection of the abdominal muscles that occurs with the open approach. The Nissen procedure may be indicated as a treatment of reflux in those who receive partial or complete response to proton pump inhibitor therapy.

## **Summary**

Laryngopharyngeal reflux (LPR) and reflux laryngitis are distinct entities from gastroesophageal reflux disease (GERD). In those who suffer from laryngopharyngeal reflux and reflux laryngitis, treatment requires lifelong therapy, either with long-term use of proton pump inhibitors or with one-time surgical correction of the lower esophageal sphincter via the Nissen fundoplication.

## Figure Legend

- Figure 1. Sagittal view of the head and neck, demonstrating the position of the esophagus behind the larynx.
- Figure 2. Picture of a normal larynx, without evidence of reflux.
- Figure 3. Severe polypoid edema of the vocal folds.
- Figure 4. Diffuse inflammation of the larynx, involving the supraglottis and the vocal folds.
- Figure 5. Vocal fold cyst (right vocal fold) and reactive nodule (left vocal fold).
- Figure 6. Vocal fold polyp.
- Figure 7. Vocal fold subepithelial cyst.
- Figure 8. Vocal process granulomas (right vocal fold).
- Figure 9. Illustration of how to properly elevate the head of bed to minimize reflux.

Figure 1.

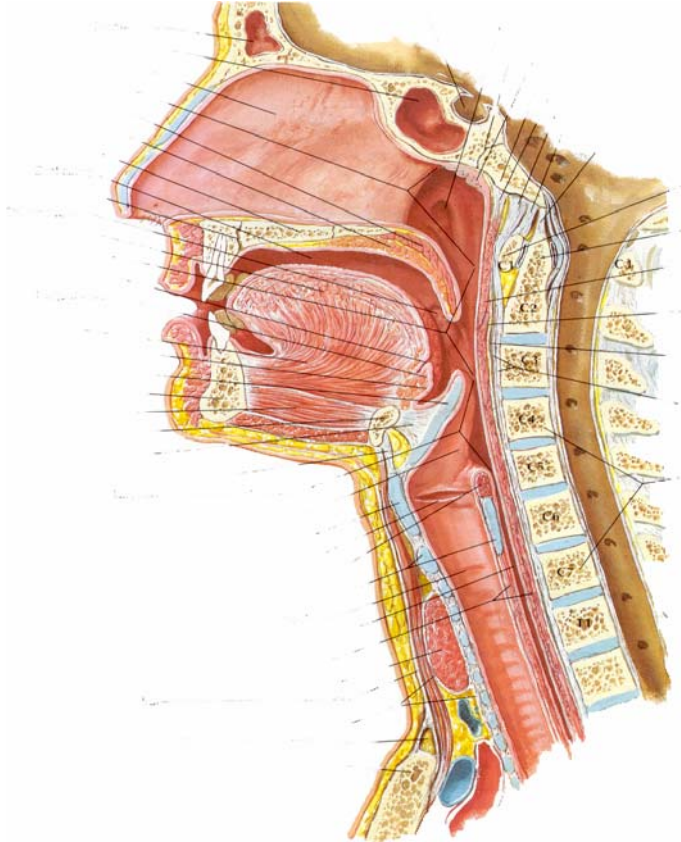
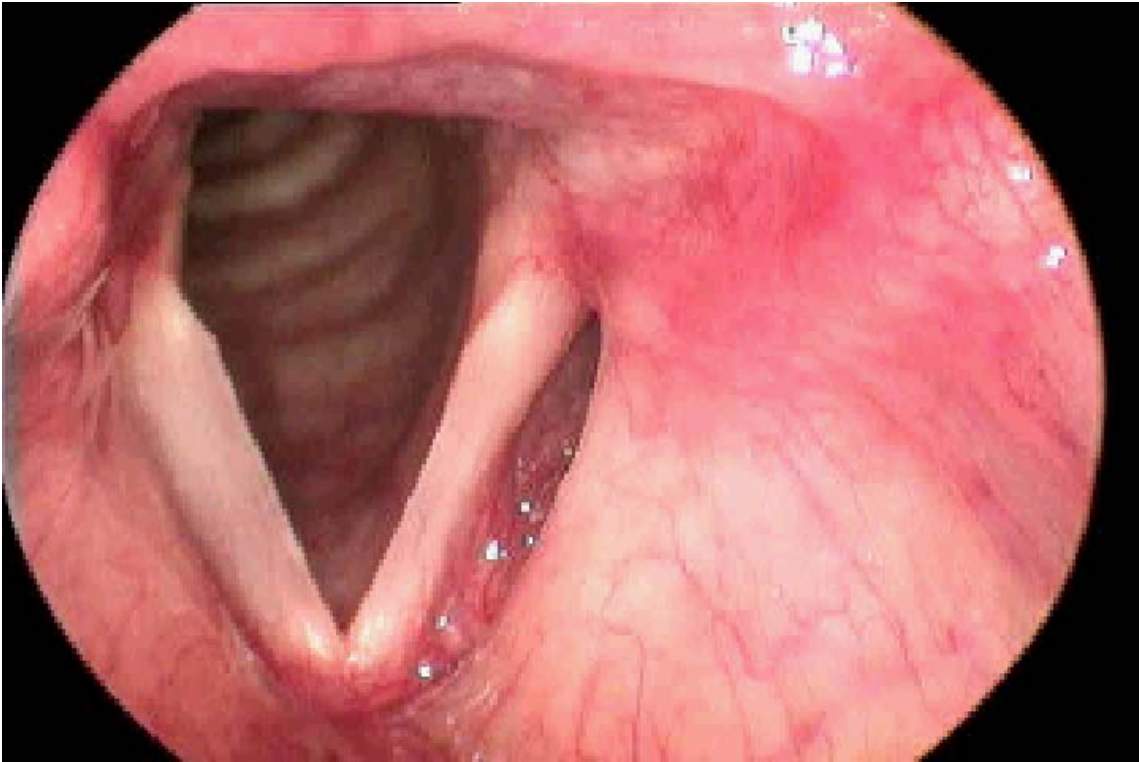


Figure 2.



**Figure 3.**

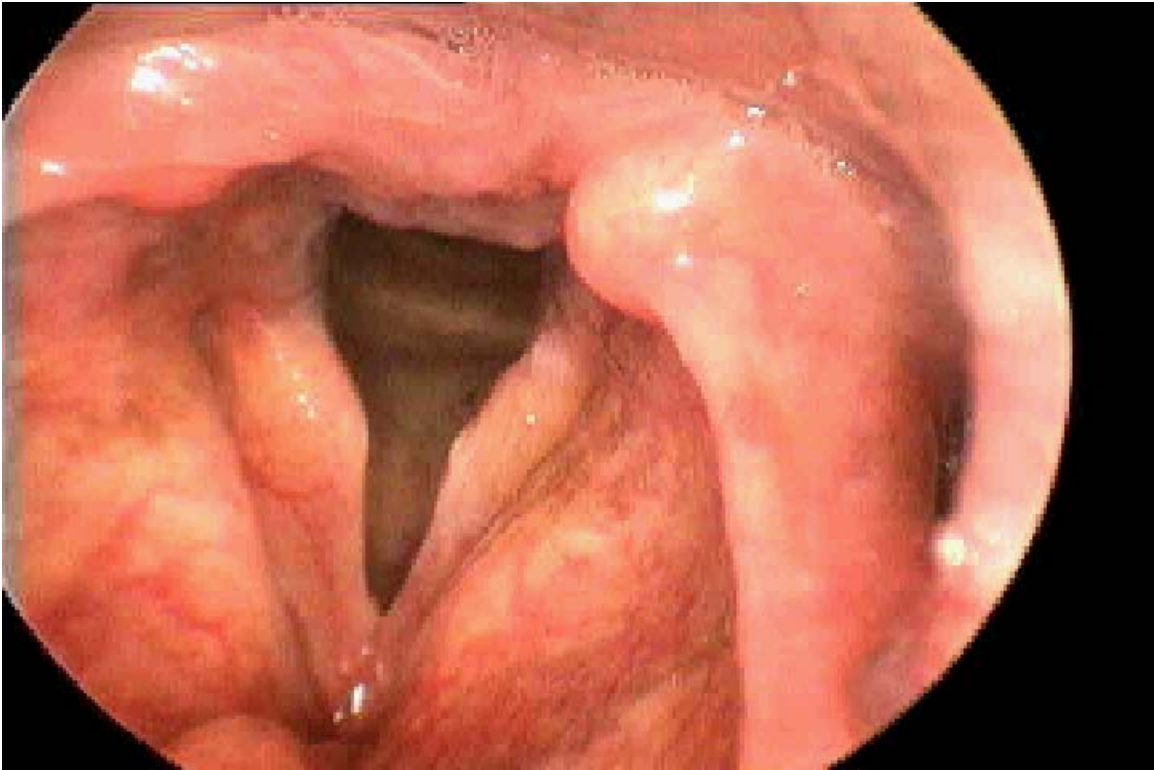
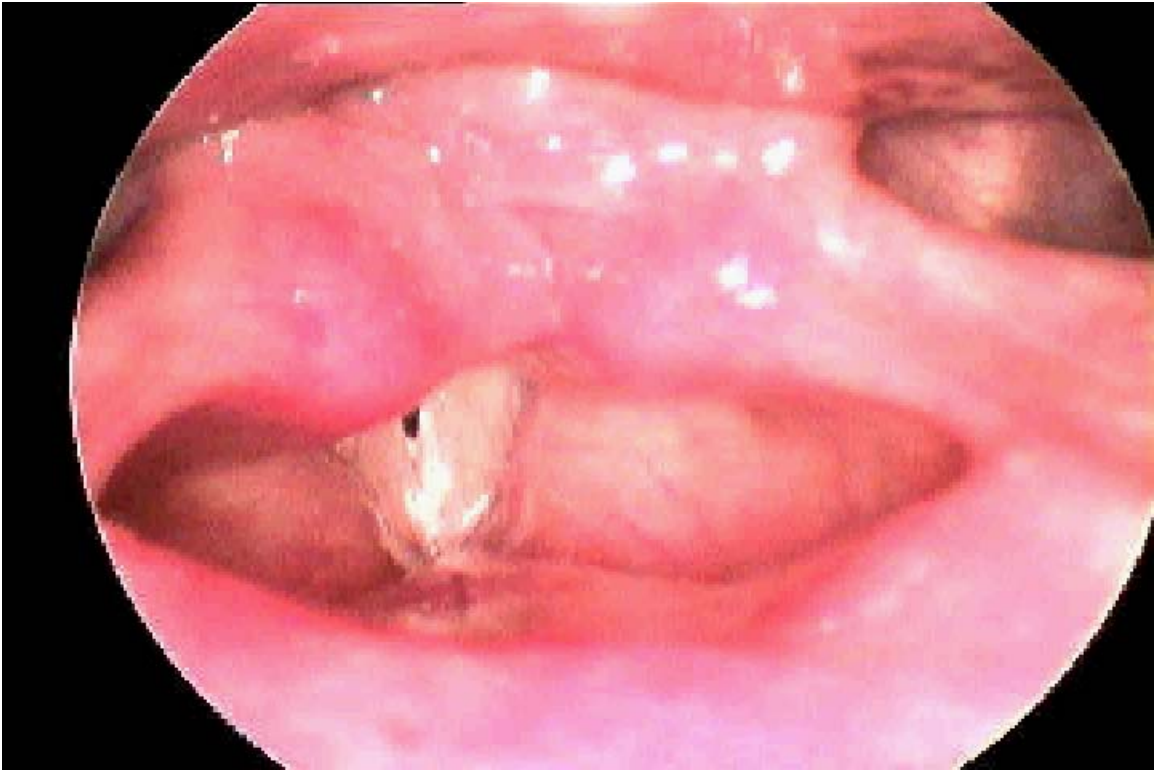


Figure 4.



**Figure 5.**

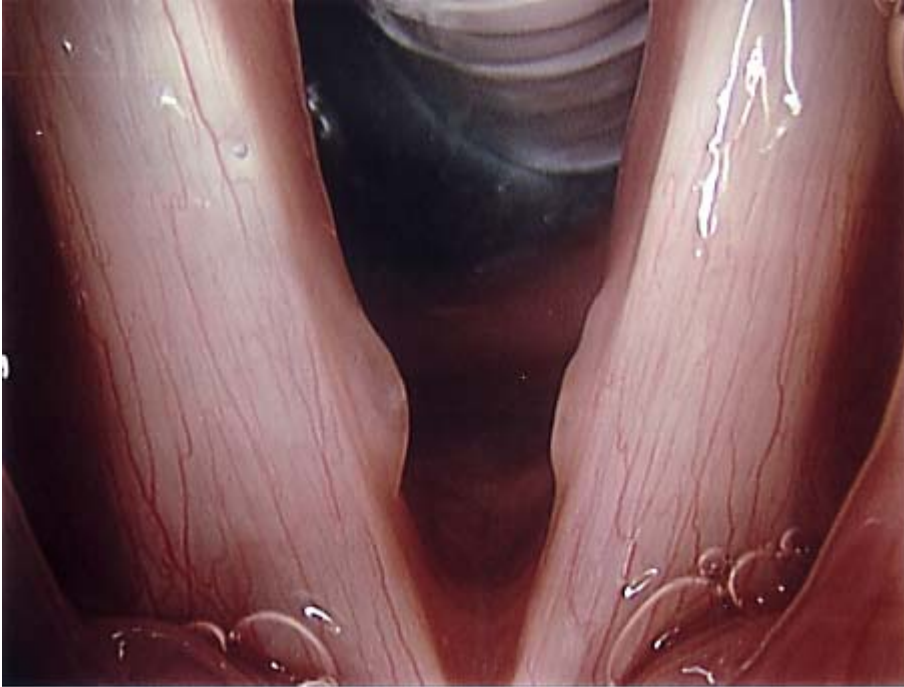


Figure 6.

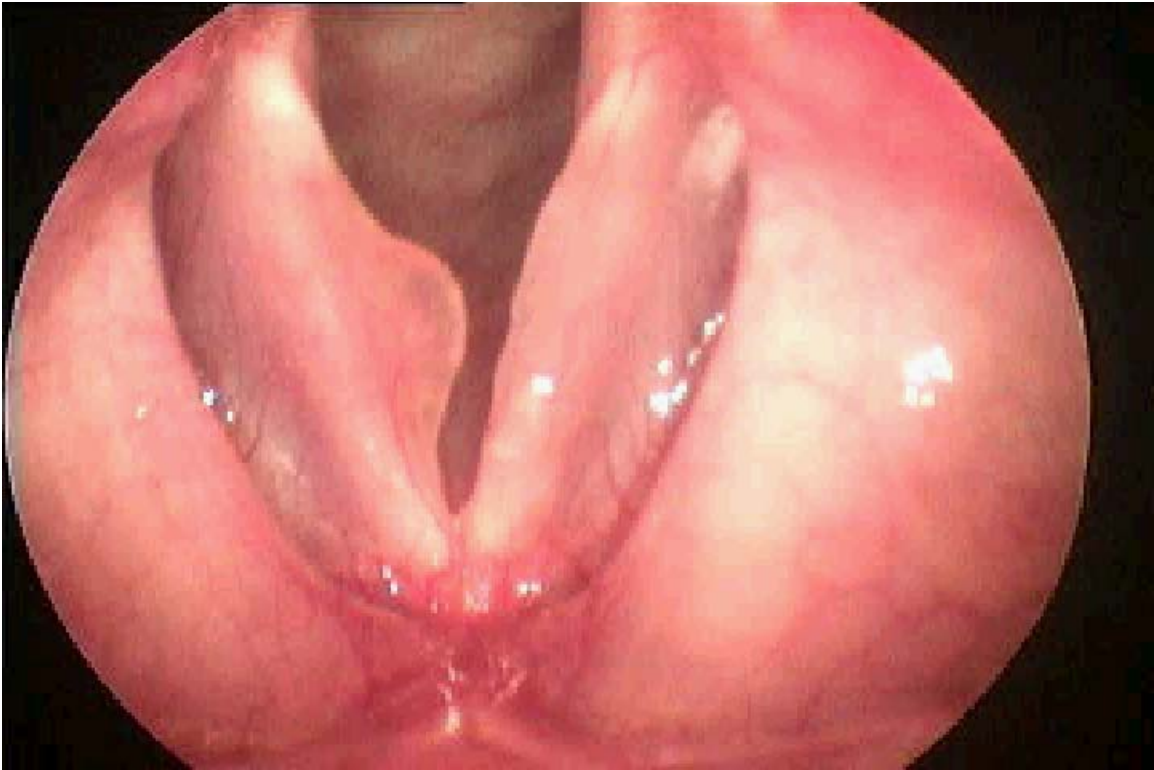


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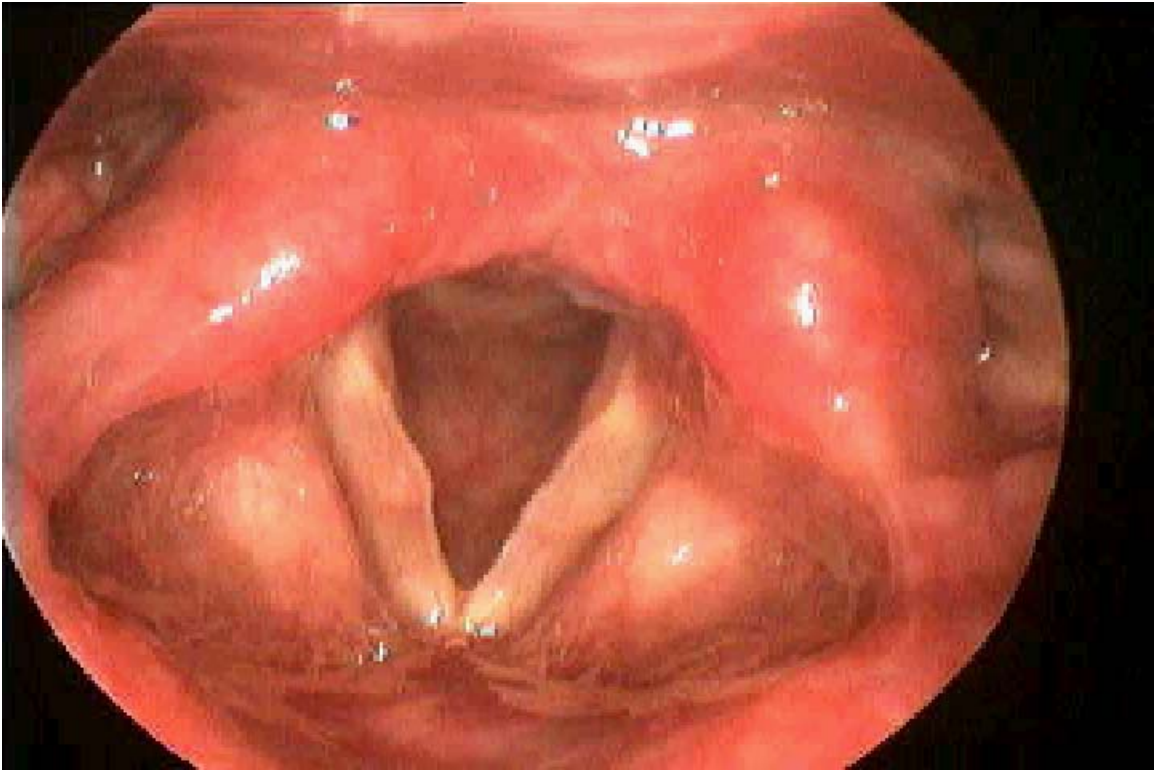


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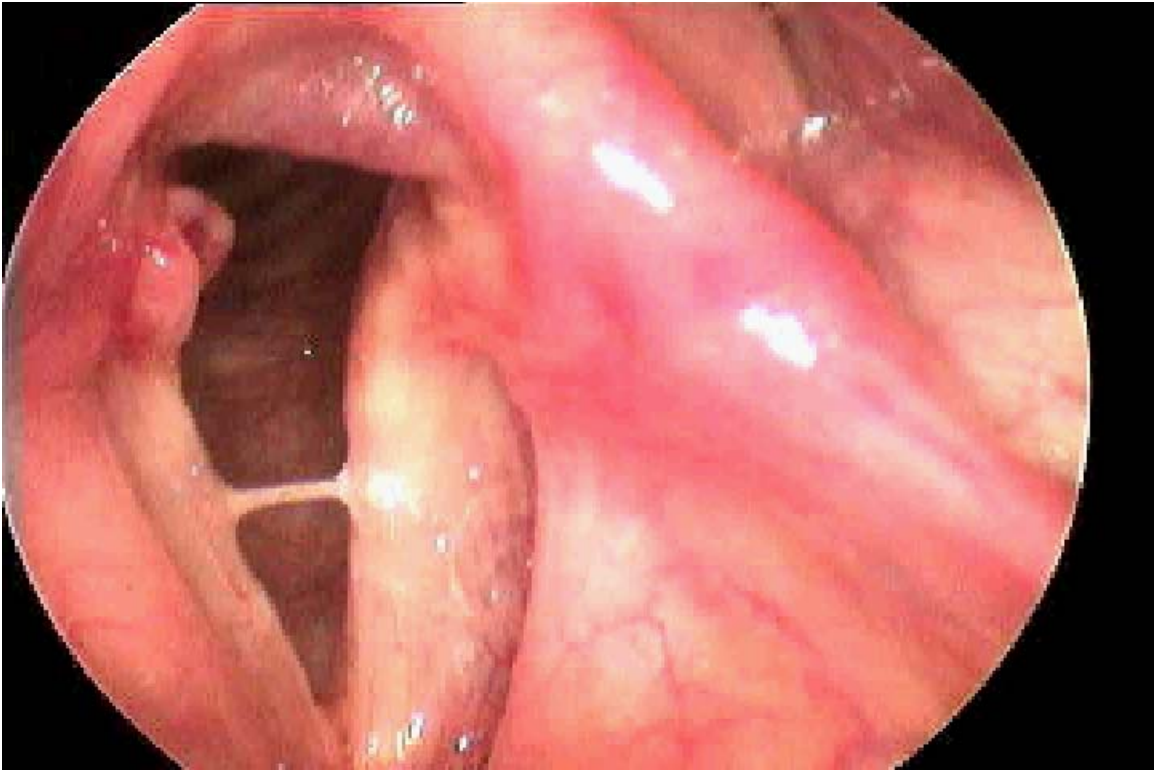
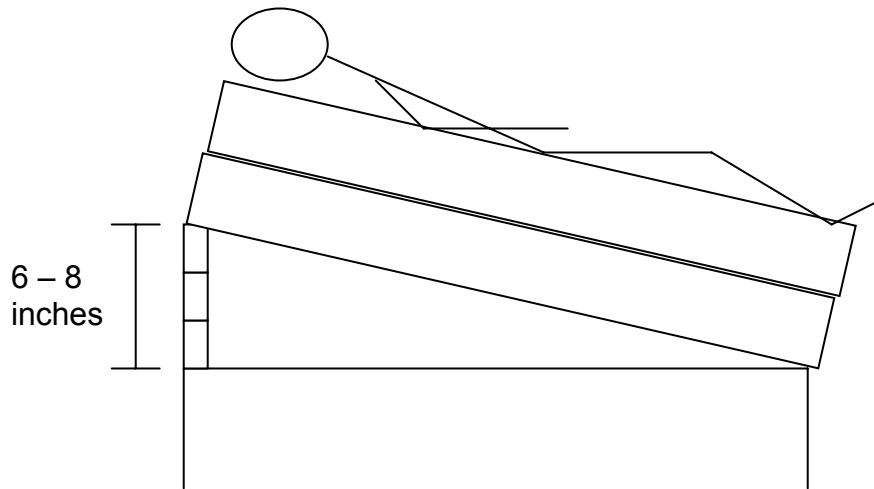


Figure 9.



**Table 1.**

**Symptoms of Laryngopharyngeal Reflux**

Chronic throat clearing
Chronic cough
Tickle in throat
Sensation of phlegm in throat
Sensation of swelling in throat
Difficulty swallowing / food getting stuck
Regurgitation of swallowed food
Hoarseness, worse in the morning upon awakening
Bitter taste in mouth
Bad Breath
Intermittent periods of inability to breathe and talk (laryngospasm)
Sensation of post-nasal drainage
Frequent thirst
Dry mouth and / or throat

**Table 2.**

**Behavioral Modifications to Treat Reflux**

Elevation of head of bed by at least 6-8 inches
Avoid exercising within 3-4 hours of eating
Avoid lying down to sleep within 3-4 hours of eating
Avoid foods and beverages that exacerbate reflux
Lose weight
Avoid cigarettes and nicotine containing products

**Table 3.**

**Foods that Aggravate Reflux**

Dairy products (milk, cheese, yogurt, sour cream)
Caffeine (coffee, tea, colas, chocolate)
Acidic foods and beverages (tomatoes, oranges, pineapple juice)
Fatty or fried foods (pizza, French fries, fried chicken)
Processed meats (hot dogs, sausages, bratwursts)
Spicy foods
Alcoholic beverages

Table 4.

**Medications to Treat Reflux**

<b><i>Proton Pump Inhibitors</i></b>	<b><i>Doses for Effective for LPR</i></b>
Nexium	40mg twice daily
Prevacid	30mg twice daily
Protonix	40mg twice daily
Aciphex	20mg twice daily
Prilosec	40mg twice daily

**Adjuvant Medications to Assist in Reflux Control**

<b>H<sub>2</sub>-Receptor Antagonists</b>
(Zantac) Ranitidine
(Pepcid) Cimetidine
(Tagamet) Famotidine
<b>Pro-motility Agents</b>
Metoclopramide
<b>Antacids</b>