

Resource utilization and variation among practitioners for evaluating voice hoarseness secondary to suspected reflux disease

A retrospective chart review

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Abstract

The purpose of this study was to assess the variation in resource utilization for the diagnosis and treatment of dysphonia or hoarseness in patients with suspected laryngopharyngeal reflux (LPRD) and/or gastroesophageal reflux (GERD). Secondary data was collected from a single-institution database of charts from patients evaluated between October 1, 2011 and March 31, 2020. This study was conducted as a retrospective chart review. Key outcome variables included demographic data, initial specialty visit, date of first symptom evaluation to final follow-up visit, additional procedural evaluation, and final diagnosis as attributed by the diagnosing physician. Inclusion criteria included patients ≥ 18 older referred to providers for suspected LPRD/GERD with a primary complaint of voice changes or hoarseness and appeared for follow-up. A total of 134 subjects were included for analysis. Data analysis included descriptive and univariate analysis, chi-square test of independence, independent means *t* test, and 1-way analysis of variance. Most patients (88) received some form of procedural evaluation in addition to clinical evaluation. The most frequent was videostroboscopy (59). Patients who first visited a gastroenterologist were more likely to undergo esophageal pH-monitoring ($n = 14$, $P < .001$) and manometry ($n = 10$, $P < .001$). Patients referred to speech-language pathology were very likely to undergo videostroboscopic evaluation ($n = 7$, $P < .001$). The prevailing final diagnosis as attributed by the diagnosing physician was confirmed to be of non-reflux etiology (49) or due to GERD alone (34). LPRD only was the least frequent diagnosis (10). Our results demonstrate that there is significant variation in the number and type of diagnostic tests based on the type of practitioner initially seen by the patient. Additionally, of patients thought to have voice change or hoarseness because of LPRD and/or GERD, more than a third had a non-reflux cause of their symptoms. Further research should identify beneficial patterns in resource utilization and further diagnostic utility of diagnostic procedures for more accurate diagnosis.

Abbreviations: GERD = gastroesophageal reflux disease, HMII = hypopharyngeal multichannel intraluminal impedance, LPRD = laryngopharyngeal reflux disease, PPI = proton pump inhibitor, SLP = speech-language pathology.

Keywords: diagnostic techniques, dysphonia, gastroesophageal reflux, laryngopharyngeal reflux, practice pattern, procedure utilization

1. Introduction

Gastroesophageal reflux disease (GERD) and laryngopharyngeal reflux disease (LPRD) have been increasing in prevalence in the United States by 4% annually since 1976.^[1] LPRD is defined as the retrograde flow of stomach contents to the upper respiratory tract, ultimately coming into contact with the larynx and pharynx.^[2] On the other hand, GERD is the reflux of gastric contents, typically acid, into the esophagus. GERD is necessary for LPRD, although the typical symptoms of GERD may or may not be present in patients with LPRD. One of the distinct manifestations of LPRD is hoarseness,^[3] sometimes

referred to as reflux laryngitis, and representing 71% to 79% of the symptoms reported.^[4] However, there are multiple causes of hoarseness. Hoarseness affects nearly one-third of the adult population at least once in their lifetime.^[5] Patients with hoarseness are evaluated by various health care providers, including otolaryngologists, primary care providers, and speech language pathologists^[6,7] (SLP). Although there is no doubt that GERD/LPRD can cause hoarseness, establishing a causal relationship in any individual patient is difficult. Numerous diagnostic tests and treatment plans are often recommended to patients with varied outcomes. An empirical trial of proton pump inhibitors (PPI) and assessing patient response is often used to establish

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a diagnosis.^[8] Patients responding well to treatment (e.g., improved voice quality) is viewed as diagnostic confirmation, although failure to improve does not rule out GERD/LPRD to many practitioners. To improve the diagnosis of LPRD-induced hoarseness, Gupta et al showed that standardizing LPRD diagnosis by calculating a reflux frequency score and reflux symptom index along with sound clinical judgment could improve outcomes and mitigate variability in care.^[8] Generally, procedural diagnostic testing is not recommended for evaluation of LPRD and evidence-based guidelines highly recommend direct laryngoscopy to assess for laryngeal pathology. However, one recent study demonstrated up-front testing with pH impedance multichannel intraluminal impedance and high-resolution manometry to be a cost-effective method in diagnosing LPRD patients, as opposed to empiric PPI trials for concurrent diagnosis and treatment.^[9] Regardless, laryngeal visualization is an important component of assessment and may predict treatment outcomes of empirical PPI trials for LPR and control the over prescription of anti-reflux medications.^[10] Guidelines for evaluation have undergone numerous iterations, highlighting the lack of diagnostic precision. The most recent update to the American Academy of Otolaryngology-Head and Neck Surgery Foundation dysphonia guidelines was in 2018.^[11] These updates include (but are not limited to) performing a laryngoscopy if symptoms have not resolved in four weeks rather than 3 months, documenting changes in quality of life and voice quality after treatment or observation and educating patients with hoarseness about risk mitigation through prevention (e.g., hydration, voice training, irritant avoidance). Following diagnostic evaluation both medical and surgical interventions are used to treat hoarseness secondary to reflux. Common therapies include PPIs, H2 receptor antagonists, speech therapy, surgical procedures, or a combination.^[3] Laparoscopic anti-reflux surgery can also effectively treat hoarseness due to LPRD.^[12] Lifestyle modifications (e.g., weight loss, alcohol avoidance, smoking cessation, etc.) are strongly recommended as adjuncts to medical and surgical treatment.^[13] Taken together, the current states of diagnosis and management of hoarseness with GERD/LPRD as a suspected cause are disappointingly variable. Given the wide variety of diagnostic tests available to assess hoarseness as well as treatments ranging from conservative to medical to surgical management, combined with the nebulous pathophysiology of LPRD, it is no wonder the assessment of hoarseness due to possible reflux confers a high economic burden on patients and physicians alike.^[14] The ambiguity surrounding approaches to diagnosing and treating GERD and/or LPRD, especially among different specialists, hinders the development of a value-based model. Elucidating practice patterns and deviations from established guidelines may help delineate the most efficacious approaches to evaluating and treating LPRD, can minimize waste of resources, and optimize patient outcomes through a value-based approach. This study's primary aim was to assess the variation in resource utilization for diagnosing and treating hoarseness with suspected LPRD and/or GERD. Our secondary aim was to assess whether specialty (i.e., otolaryngology, gastroenterology, speech pathology, or general surgery) differed in resource utilization.

2. Methods

2.1. Study design, setting, and participants

The study received institutional review board approval from the respective institution. A retrospective cohort study was conducted using a retrospective chart review. Inclusion criteria included all consecutive patients aged 18 and older referred to providers between October 1, 2011, and March 31, 2020, for suspected LPRD/GERD with a primary complaint of voice changes or hoarseness and appeared for follow-up. Subjects were first identified via ICD-9 codes 784.42 (dysphonia) and

530.81 (gastroesophageal reflux disease), and ICD 10 codes (R49.0 dysphonia), 784.49 (other voice and resonance disorders), and K21.9 (gastroesophageal reflux disease). Retrieved patient charts were screened for inclusion.

2.2. Variables

Clinical information was obtained via chart review and medical records, including demographic data. Initial specialty visit was determined as the first visit to an otolaryngologist, gastroenterologist, speech-language pathologist, or general surgeon with a primary complaint of hoarseness or voice changes due to suspected LPRD/GERD. Evaluation and treatment period was determined as the first instance of symptom evaluation to the final follow-up visit. Instances of additional instrumental evaluation were collected via the patient chart and relevant outside medical records. The definitive diagnosis was determined as the diagnosis consistently recorded in an assessment during the patient's last visits to their respective physician. Diagnoses were recorded as stated in the medical record by the treating physician. We could not independently confirm the stated diagnoses.

2.3. Statistical analysis

Descriptive analyses were used to examine demographic, treatment, and procedural evaluations and final diagnosis characteristics of the patients. Furthermore, an association of specialty of initial visit and each type of the additional instrumental evaluation was conducted using Chi-square test of independence. *P* values <.05 indicated statistical significance. All analyses were conducted by using the SAS software version 9.4 (SAS Institute Inc.).

3. Results

3.1. Patient demographics

A total of 1749 patients with a primary complaint of voice changes/hoarseness were identified via ICD-9 or ICD-10 codes. After screening and examining for eligibility, 134 subjects met inclusion criteria for chart review and analysis. Reasons for exclusion included inappropriate age, evaluation outside of date parameters, no evaluation for the primary complaint of interest, etiology of voice changes, and hoarseness not suspected to be due to reflux, or they were not evaluated by designated specialists. Most patients who were referred for voice symptoms identified their ethnicity as "not Hispanic/Latino" (67%), while 26% of patients did not report their ethnicity (Table 1). The majority of patients referred were female (69%) (Table 1). Additionally, most patients with voice complaints were White (70%), while fewer Black/African American people were referred for voice complaints (16%) (Table 1). Fifteen subjects' races were not reported (11%). Additionally, most patients were reported to be either employed (33%) or retired (34%) (Table 1). Most patients were reported to be married at the time of initial evaluation (54%).

3.2. Treatment and evaluation period

Most patients (68%) first went to an otolaryngologist for their voice complaints with suspected LPR, with the next most common initial visit specialty being gastroenterology (22%) (Table 2). After initial referral, most patients' evaluation and treatment period were comprised of six or fewer visits, with some patients completing as many as 20 visits to varying specialties during their evaluation and treatment period. Additionally, most patients had evaluation and treatment periods between 10 and 20 months, though some patients were evaluated for up to 70 months (median 8.76, IQR 22.2) (Table 3).

Table 1
Patient Demographics (N = 134).

Ethnicity	n (%)
Hispanic/Latine	9 (7)
Not Hispanic/Latine	90 (67)
Unknown	35 (26)
Gender	
Male	41 (31)
Female	93 (69)
Race	
American Indian/Alaska Native	1 (1)
Asian	1 (1)
Black/African American	22 (16)
Native Hawaiian/Pacific Islander	1 (1)
White	94 (70)
Other/Unknown	15 (11)
Employment Status	
Employed	44 (33)
Unemployed	17 (13)
Retired	46 (34)
Disabled	15 (11)
Unknown	12 (9)
Marital Status	
Married	72 (54)
Divorced	17 (13)
Widowed	7 (5)
Separated	2 (1)
Single	33 (25)
Unknown	3 (2)

Table 2
Frequencies of initial visit specialty.

Initial visit specialty	n (%)
Otolaryngology	91 (68)
Gastroenterology	29 (22)
General Surgery	7 (5)
Speech Language Pathology	7 (5)
Total	134 (100)

Table 3
Evaluation and treatment period length (months) by initial visit specialty.

Initial visit specialty	n	Mean	Standard error	Median	Range	Interquartile range (IQR)
Otolaryngology	91	17.49	1.97	9.85	0.60–72	22.6
Gastroenterology	29	13.79	2.63	8.33	0.73–52.5	14
General Surgery	7	5.01	1.50	4.00	1.50–13.30	3.73
Speech Language Pathology	7	20.37	4.97	22.10	0.20–35.20	27.33

Based on the initial specialty visit, those who were first referred to speech-language pathology had the longest median evaluation and treatment periods (median 22.10, IQR 27.33). Those who first went to an otolaryngologist had a wider evaluation and treatment time (range 0.60–72) but shorter median evaluation and treatment times than SLP (median 9.85, IQR 22.6). Those who went to a general surgeon had the shortest median evaluation and treatment periods (median 4, IQR 3.73, range 1.5–13.3) (Table 3).

Regarding the number of visits following initial specialty, those who first went to otolaryngology, gastroenterology, or general surgery had similar median total number of visits

Table 4
Number of visits to all specialties following initial visit specialty.

Initial visit specialty	n	Mean	Standard error	Median	Range	IQR
Otolaryngology	91	5.3	0.38	4	2–20	3
Gastroenterology	29	4.55	0.46	4	2–11	4
General Surgery	7	4.71	1.29	3	2–12	2
Speech Language Pathology	7	9.43	1.98	8	3–18	5.5

IQR = interquartile range.

(Table 4). Those who first visited SLP first tended to have a greater number of total visits over the course of their evaluation and treatment period as compared to other specialties (median 8, range 3–18, IQR 5.5). Regardless of initial specialty visit, patients experienced a wide range of total number of visits over the course of their evaluation and treatment period (Table 4).

We also evaluated the rate of cross referrals to other specialties following initial visit specialty. After visiting an otolaryngologist first, 24% of those patients later visited gastroenterology and 48% of patients visited speech language pathology (Table 5). Of patients who first visited gastroenterology, 55% of them later visited otolaryngology, 14% visited general surgery, and 21% visited speech language pathology. Patients who first went to general surgery were evenly distributed among visits to otolaryngology, gastroenterology, and speech language pathology. Among patients who first visited speech language pathology, all of them later visited otolaryngology, and only one patient visited gastroenterology and/or general surgery (Table 5). We did not delineate in what order these subsequent visits occurred following the first visit.

3.3. Procedural evaluation in addition to clinical evaluation

We evaluated five evaluation modalities—endoscopy, barium esophagram, pH-monitoring, esophageal manometry, and videostroboscopy. The majority of patients (66%) received one or more diagnostic procedures in addition to a clinical/non-instrumental voice evaluation. Videostroboscopy was performed most frequently (44%), while barium esophagram was performed least frequently (13%) (Table 6). While most patients received some form of procedural evaluation, most received only one or two additional evaluations. A select few received all five procedural evaluations of interest (Fig. 1).

Based on an initial visit, those who first visited a gastroenterologist were more likely to receive esophageal pH monitoring ($P < .001$) and esophageal manometry ($P < .001$) throughout evaluation and treatment for their voice complaints. Those who first were referred to speech- language pathology for voice complaints were very likely to undergo videostroboscopy ($P < .001$). Patients first referred to general surgery were very likely to undergo endoscopy ($P = .02$) (Table 7).

3.4. Final diagnoses

After evaluation and treatment of hoarseness (due to suspected LPRD/GERD) was completed, the final diagnoses attributed by the diagnosing physicians were as follows: non-reflux etiology (37%); GERD (25%); LPRD (10%); GERD/LPRD + non-reflux etiology (17%) (Table 8). Non-reflux related diagnoses included allergic rhinitis, vocal cord atrophy, chronic sore throat, functional voice disorder (VD), malignancy, muscle tension dysphonia, vocal cord dysfunction/trauma, and dysphonia with unclear etiology. Therefore, of the patients specifically referred to a specialist for hoarseness with reflux as the suspected cause, 54% had some other reason for their symptoms.

Table 5

Number and percentage of patients who visited other specialties for voice hoarseness following initial visit, and total number of patients who visited their respective initial visit specialty. Some patients may not have visited any other specialty following their initial visit, and some patients may have visited multiple specialties following their initial visit.

Initial visit specialty	Total, n	Follow-up visit specialties			
		Otolaryngology, n (%)	Gastroenterology, n (%)	General Surgery, n (%)	SLP, n (%)
Otolaryngology	91	-	22 (24)	2 (2)	44 (48)
Gastroenterology	29	16 (55)	-	4 (14)	6 (21)
General Surgery	7	2 (29)	2 (29)	-	2 (29)
SLP	7	7 (100)	1 (14)	1 (14)	-

SLP = speech-language pathology.

Table 6

Frequencies of additional procedural evaluations received by patients (out of N = 134).

Additional evaluation received	n (%)
Any extra evaluation	88 (66)
Videostroboscopy	59 (44)
Endoscopy	38 (28)
pH-monitoring	28 (21)
Manometry	24 (18)
Barium esophagography	18 (13)

4. Discussion

Our study has a few important findings: Firstly, of the patients thought to have hoarseness because of reflux, whether GERD and/or LPRD, about 54% had a non-reflux cause thought to be the cause of or contributory to their symptoms. Secondly, there was a significant variation in the number of diagnostic tests based on the type of practitioner initially seen by the patient. Thirdly, there is a prevailing misunderstanding of the nature of the relationship between GERD and LPRD given that some physicians attributed hoarseness to just one or the other, or both.

Regarding voice complaints in this cohort, most patients presented to an otolaryngologist for their initial visit, with the second most visited specialty being gastroenterology. This is consistent with other referral patterns described as most patients will first go to an otolaryngologist before pursuing care with other subspecialties.^[5] Further, the practice patterns and utilization of diagnostic evaluation for hoarseness possibly due to LPRD among specialists seem quite variable. In our study, regardless of initial visit specialty, most patients received at least one instrumental evaluation. The type of evaluation also appears to be related to the types of tests most associated with the specialist (as the old aphorism goes—“When you have a hammer, the world looks like a nail”). There was a strong association between the initial visit to a speech-language pathologist and undergoing videostroboscopy. Videostroboscopy is a mainstay of practice among speech-language pathologists, and it complements laryngoscopy performed by otolaryngologists in the evaluation of laryngeal anatomy. Videostroboscopy can assess laryngeal anatomy and physiology. The ability to evaluate real-time laryngeal function may assist with identifying and monitoring disease progression.^[15] Studies suggest videostroboscopy may play an important role in the diagnosis of LPRD.^[13,16] There was also a significant association between the initial visit to gastroenterology and undergoing esophageal pH-monitoring and esophageal manometry for LPR. While pH-monitoring serves as a gold standard for GERD diagnosis, the utility of the diagnostic test for identifying LPRD is still unclear. A report by Hoppe et al suggested the use of hypopharyngeal multichannel intraluminal impedance (HMII) for the detection of LPR events. This test focuses on impedance

changes in the hypopharynx to detect episodes of pharyngeal reflux rather than pH-centric detection.^[17] The shift from characterizing LPRD solely as an acid reflux event associated with GERD and focusing on detecting both acid and nonacid reflux events may yield more accurate LPRD diagnoses, however, HMII is not universally accepted for diagnosing LPRD. Though endoscopy was used in evaluation for some patients in this cohort, there is little literature on practice patterns and the use of endoscopy specifically for evaluating LPR. Finally, in our study, only 21% of patients received a final diagnosis of LPRD or LPRD + GERD, representing a small cohort of a frequently over-diagnosed condition. Many studies have shown practice patterns of over diagnosis of LPRD based on lack of further clinical evaluation and assignment of the diagnosis when the etiology of hoarseness may not be readily discerned.^[5,16,18,19] Other conditions that can cause hoarseness include vocal fold lesions, vocal fold paresis, vocal misuse and overuse, and even allergic rhinitis and asthma.

Our results show significant variability in patient evaluation, and this variability was dependent on the specialty first seen. Others have noted similar observations. In a study describing referral patterns by gastroenterologists and otolaryngologists by Haines and colleagues, otolaryngologists were more likely to refer out to gastroenterologists for suspected LPR/GERD than gastroenterologists despite seeing fewer patients overall.^[20] Conversely, our study showed a higher rate of patient visits from gastroenterology to otolaryngology as compared to visits from otolaryngology to gastroenterology. It is unclear whether these were direct referrals or patient choice. We can theorize about this pattern extensively. As noted, we had a true LPRD and LPRD + GERD incidence at just 21%, so there is a possibility that otolaryngology successfully diagnosed and managed cause of hoarseness without warranting further visits to gastroenterology for a reflux etiology. It is also possible that our team of otolaryngologists did not feel the need to refer out to gastroenterology. Patients may not have been willing to undergo additional invasive GI diagnostic testing such as endoscopy, pH testing, or HMII, and therefore continued to follow with otolaryngology for management of hoarseness. It is unclear which combinations of medical specialty and diagnostic testing most efficaciously diagnoses LPRD with efficient use of resources, reduction of waste, and effective disease management.

Despite similar number of visits over the course of an evaluation and treatment period among specialties, some patients were evaluated and treated up to 6 years. Again, we can hypothesize extensively as to why some patients took so long to receive a proper diagnosis. Possible explanations might have included inaccessibility to physicians, loss to follow-up, and even waxing and waning symptoms necessitating repeat visits over several years. Regardless of the cause, the prolonged evaluation and treatment period for some patients confers a large amount of waste both in time and resources for physicians and patients alike. The lack of adherence to a structured evaluation and

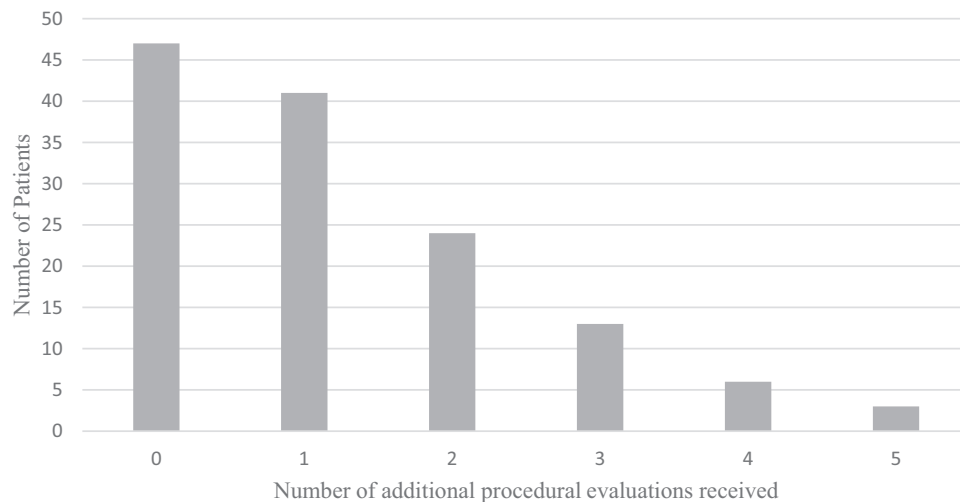


Figure 1. Frequencies of number of additional procedural evaluations received by patients.

Table 7

Additional procedural evaluations done throughout evaluation and treatment by initial specialty visit.

	Initial visit specialty otolaryngology, n (%)	Initial visit specialty gastroenterology, n (%)	Initial visit specialty general surgery, n (%)	Initial visit specialty SLP, n (%)	p value
Any evaluation	54 (59)	22 (76)	5 (71)	7 (100)	.0704
Endoscopy	20 (22)	13 (45)	4 (57)	1 (14)	.0226*
Barium esophagography	12 (13)	3 (10)	1 (14)	2 (29)	.6088
pH-monitoring	12 (13)	14 (48)	1 (14)	1 (14)	.0014*
Manometry	10 (11)	10 (35)	3 (43)	1 (14)	.0078*
Videostroboscopy	44 (48)	10 (21)	2 (29)	7 (100)	.0003*

*Denotes statistical significance at the 5% level.

SLP = speech language pathology.

treatment guideline - in an attempt at a thorough work up - may have led to a delayed final diagnosis for patients with etiologies that were not related to reflux.

As discussed, there is little consistency in the evaluation methods to evaluate possible LPRD; though in our study, most patients did undergo some instrumental evaluation. This may be due to the poor performance of these tests in securing the diagnosis of LPRD-induced hoarseness. One review described that due to poor sensitivity (70%–80%) and specificity (20%–50%), pH-monitoring should not be used in clinical practice to identify LPRD. Regarding manometry, the same review makes no recommendations regarding the use of manometry for the diagnosis of LPRD as there is a further exploration of LPRD.^[21] In one cross-sectional study exploring the use of videostroboscopy in diagnosing LPRD in teachers with voice disorder, there was no association between VD and LPRD.^[22] In another study among six tertiary care academic laryngology centers, 76.5% of patients had alternative pathologies to LPRD that were diagnosed with laryngeal stroboscopy. Therefore, it may be necessary to identify other causes of hoarseness. Lastly, in one review, EGD is described as having limited utility in evaluating atypical extraesophageal GERD symptoms suspicious for LPR and is mainly used for evaluation of esophagitis with atypical GERD symptoms.^[23] Taken together, the variability in diagnostic testing performed may be due to a lack of consensus on which instrumental assessments most reliably diagnose LPRD-related voice changes. Therefore, practitioners are left with those tests that they know best rather than approaching their patients with a value-based care approach for ideal outcomes and with a large of waste of resources.

Table 8

Final diagnoses received by patients as attributed by diagnosing physician.

Final diagnosis	N (%)
Non-reflux etiology	49 (37)
GERD	34 (25)
GERD/LPRD + non-reflux etiology	23 (17)
LPRD + GERD	15 (11)
LPRD	13 (10)

GERD = gastroesophageal reflux disease, LPRD = laryngopharyngeal reflux disease.

Based on our findings, we would suggest a specific evaluation and treatment algorithm for hoarseness due to suspected LPRD. Our suggested algorithm is similar to those that already exist with additional recommendations on specific uses of diagnostic evaluation.^[11,21,24] Based on our findings, we propose the following diagnosis, treatment, and referral algorithm (Fig. 2). For a patient presenting with chronic hoarseness (>4 weeks), we first recommend evaluation for many common causes of hoarseness including allergy, rhinitis, vocal abuse and/or trauma, and smoking history, among others. Those causes should be treated accordingly. All patients, regardless of cause, should be educated on lifestyle modifications including good hydration and avoiding inflammatory and acidic foods, vocal health, and smoking cessation. For patients who do not fall into those categories or fail treatment, they should first be visualized with indirect laryngoscopy with an otolaryngologist. Patients with suspected malignancy, vocal cord nodules, or polyps, should be managed with

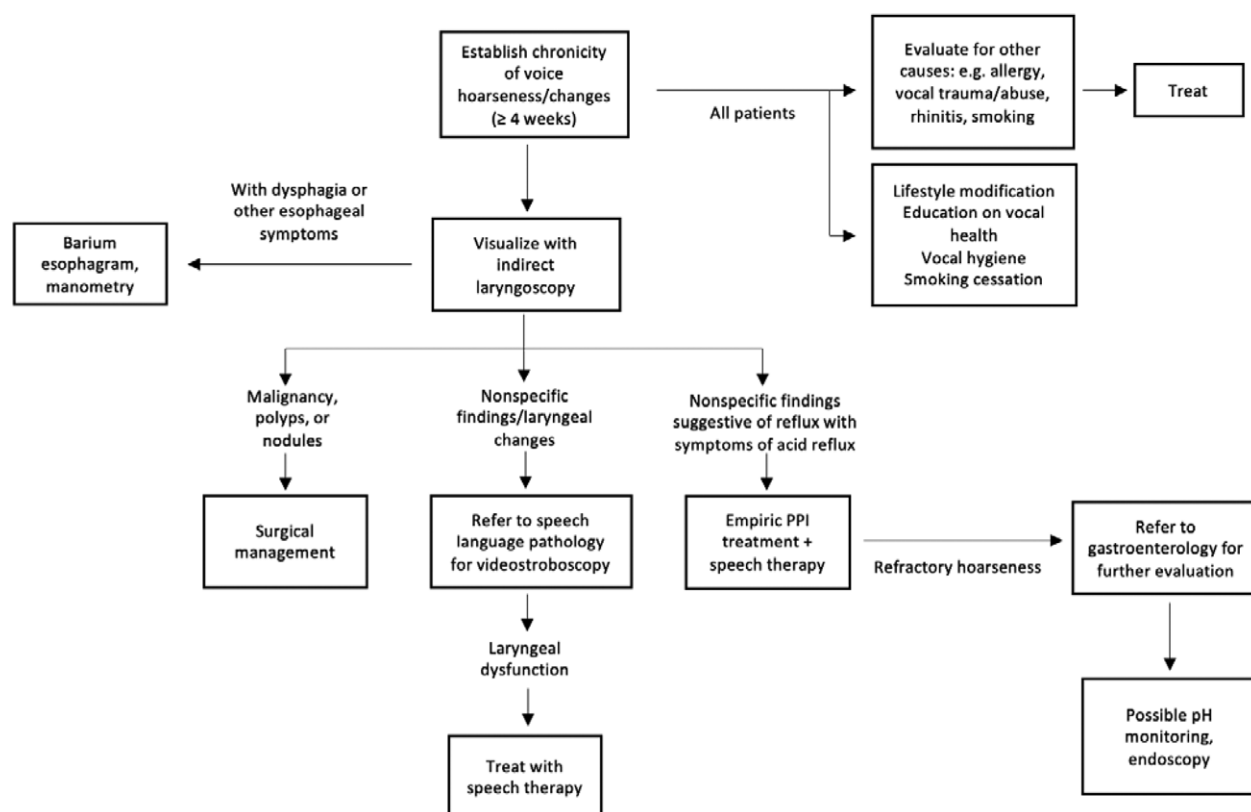


Figure 2. Suggested referral, diagnosis, and treatment algorithm for patients presenting with hoarseness as a primary complaint with suspected laryngopharyngeal reflux disease (LPRD) (PPI = proton-pump inhibitor).

surgery. Patients with nonspecific findings and with laryngeal symptoms should be referred to speech pathology for evaluation with videostroboscopy, and laryngeal dysfunction should be managed with speech therapy. For patients with symptoms of acid reflux and nonspecific findings on laryngoscopy, treatment should begin with empiric PPIs and speech therapy. Those patients with refractory hoarseness should be referred to gastroenterology for further evaluation with possible endoscopy and pH monitoring. Manometry and barium esophagram should only be used in patients with dysphagia or other esophageal symptoms.

With this discussion of the diagnostic utility of various tests for reflux as a cause of hoarseness, there remains a nebulous relationship between GERD and LPRD. Can LPRD exist without clinical or diagnostic signs of GERD, or are they inherently related to each other? In our study, diagnoses ranged from sole GERD causing hoarseness to sole LPRD causing hoarseness, to a combination of both.

There are several reasons why some physicians may have chosen to make a distinction. Perhaps the physician believed that a diagnosis of GERD causing hoarseness implied the laryngopharyngeal reflux aspect and did not feel the need to distinguish another uniquely occurring disease process. Some physicians may have stated that LPRD occurs because of GERD and stated the diagnosis without relying on the implications. Based on the discussion above, it is not surprising that there is difficulty in finding a gold-standard test to diagnose LPRD in addition to clinical history. The question we should ask then is if hoarseness due to LPRD is an extension of GERD or is it its own pathophysiological process. Alternatively, it may be due to an entirely non-reflux etiology.

Like most studies, this study is not without limitations. First, though many precautions were taken, and explicit guidelines were developed for extracting data points from patient charts, with cross-reference between two extractors to confirm the accuracy of data collection, there is always the potential for subjective error in data extraction for retrospective chart reviews.

Additionally, this study could have benefited from a larger sample size, leading to more significant and more strongly supported findings after statistical analysis. Another limitation was the exclusion of exploring practice patterns of primary care physicians who may have initially diagnosed and treated suspected LPRD due to presenting complaints of hoarseness. Another approach for this study could have been to look at the practice patterns of the selected physicians for all possible causes of hoarseness, not just an initial diagnosis of LPRD. One major weakness of the paper was the inability to independently confirm final patient diagnoses, instead of relying solely on what the treating physician reported in the patient chart. Finally, the lack of existing research on the resource utilization of various specialties in evaluating and treating suspected LPRD posed a challenge.

There is ample opportunity for further research in evaluating hoarseness, possibly secondary to LPRD. First, it should be properly delineated whether voice conditions present predominantly with additional gastrointestinal symptoms or more solitary voice symptoms. Patients with suspected LPRD and a higher incidence of GERD symptoms may benefit from initial evaluation by a gastroenterologist. The practice patterns of otolaryngologists, gastroenterologists, speech language pathologists, general surgeons, and primary care physicians should continue to be studied and characterized. As previously discussed, there is scarce and conflicting research in terms of recommendations for videostroboscopy, endoscopy, esophageal pH-monitoring, esophageal manometry, and barium esophagram for a suspected diagnosis of LPRD. In guidelines released by Francis and colleagues, the only procedural diagnostic method with recommendations is indirect laryngoscopy, which is strongly recommended before pursuing treatment.^[25] Yet, we see patients undergoing additional evaluation, sometimes up to five different procedures, to explore possible LPRD conferring a large waste of resources. This may be contributing to the high economic burden caused by suspected extraesophageal reflux when it represents a narrow cohort of

patients with voice complaints.^[14] The utility of different diagnostic tests may aid primarily in ruling out causes of hoarseness, such as malignancy, esophageal lesions, dysmotility, Zenker diverticulum, and other issues. In an algorithm proposed by Lechien and colleagues, primary care providers may effectively help to identify a cause of hoarseness, including LPR, by spotting “red flag” signs that may warrant referral to an otolaryngologist or a gastroenterologist.^[24] Additionally, symptom outcomes after the use of various diagnostic procedures should be explored for any potential association or even a lack of association with favorable outcomes and voice symptom improvement. An emphasis on value-based care with focus on patient outcomes is likely to reduce the chances of over-diagnosis of LPRD while reducing waste of resources by various providers. Additional research in this area may also help prevent physicians from over-diagnosing LPRD as a cause of hoarseness. It is possible they may miss more sinister conditions such as malignancy causing voice changes. Finally, it should be decided whether LPRD as a cause of hoarseness always exists in relation to GERD, or if some aspect of anatomy and physiology may imply the existence of isolated LPRD even warranting it the exploration of diagnostic tests for LPRD beyond clinical diagnosis.

5. Conclusion

The exact nature of reflux disease causing hoarseness, both GERD and LPRD, continues to be a controversial and vexing diagnosis for otolaryngologists, gastroenterologists, and other practitioners who may be approached by those seeking relief for hoarseness and other voice symptoms. With such a wide variety of procedural modalities in addition to clinical evaluation by history and physical exams, physicians and other practitioners continue to evaluate reflux without standardization in diagnosis and diagnostic criteria for LPRD/GERD as causing hoarseness. We found inconsistency in the evaluation of suspected LPRD/GERD in our Center with varying providers involved, diagnostic examinations performed, and duration of evaluation and treatment which, in some cases, resulted in multiple providers, tests, treatments and lengthy delays in securing an accurate diagnosis. Practitioners and patients have wasted resources in finding a diagnosis, whether it is time, finances, or materials required for diagnostic procedures. Deviation from best practice guidelines and focus more familiar moves them away from a values-based care approach. Though this condition continues to pose challenges, there are ample opportunities for improvement in the practice of approaching voice symptoms with LPRD/GERD as a possible etiology. Future studies will hopefully identify beneficial patterns in resource utilization and a value-based care approach in evaluating and treating LPRD for a reduction in waste, quicker diagnoses, and overall improved quality of life for patients.

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