

Laryngopharyngeal symptoms in patients with asthma: a cross-sectional controlled study

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Abstract

Objective: To examine the frequency and severity of laryngopharyngeal symptoms in asthmatic patients. The role of laryngopharyngeal reflux disease as a co-morbid disease to asthma has not been previously reported.

Subjects and Method: Seventy-two subjects, 36 asthmatics and 36 controls were included in this study. Demographic data included age, gender, status of asthma, use of steroid inhalers, smoking and history of allergy. Pulmonary function test was reported in 13 subjects. The evaluation consisted of filling the Reflux Symptom Index (RSI) described by Belafsky *et al.* The total score, frequency and average score of each laryngopharyngeal symptom was computed in both groups.

Results: The mean age of patients was 46.61 ± 17.59 years with a female to male ratio of 2.3:1. Twenty patients were using steroid inhalers. Close to one third were smokers (30.6%) and 55.6% had allergic rhinitis. Thirty-six percent had controlled asthma vs 64% were uncontrolled. The mean of the total RSI was significantly higher in patients compared with controls (12.03 ± 8.3 vs 6.64 ± 6.08 , P value < 0.05). In the asthmatic group, 15 subjects had a positive RSI compared with only 4 in the control group (P value of 0.003). There was a significant difference in the prevalence and means of four laryngopharyngeal symptoms in patients vs controls.

Conclusion: Laryngopharyngeal reflux disease is more prevalent and more severe in patients with asthma vs controls.

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Conflict of interest

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

Introduction

There are ubiquitous reports on the ambivalent relationship between asthma and reflux with the main focus being on gastroesophageal reflux disease (GERD). GERD has been incriminated in the adult onset of

asthma, extent of control, exacerbation of events and response to medical treatment. A recent survey by the German National Health showed that 49.6% of adults with asthma had GERD and that the exacerbation prevalence was higher among patients with GERD (9.8% vs 8.2%) (1). In children, the prevalence seems to

Key words

asthma – cough – hoarseness – laryngopharyngeal symptoms – reflux

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Authorship and contributorship

Abdul Latif Hamdan: Designed the research study and wrote the manuscript. Hussein Jaffal: Performed the Literature Review. Rachel Btaiche: Collected Data. Zaahir A. Turfe: Performed literature review and analyzed the data. Ibrahim Bawab: Collected data. Nadim Kanj: Diagnosed the patients and referred them for vocal assessment. Hani Tamim: Performed the statistical analysis.

Ethics

This study has been approved by the Institutional Review Board at the American University of Beirut following the ethical standards laid down in the Declaration of Helsinki.

be higher with an 80% figure reported by Blake and Teague (2). On the other hand, cough and abdominal distention in asthmatic patients have also been described as precipitating factors for GERD (3).

Despite the redundancy in the studies on the prevalence of gastrointestinal symptoms in patients with asthma, there are no reports on the prevalence of laryngopharyngeal symptoms in this group of population. The extent to which asthma is linked to laryngopharyngeal reflux disease (LPRD) has not been fully investigated. LPRD is considered by some as a variant of GERD and by many others as a separate entity (4, 5). It represents a complex spectrum of abnormalities that are present in almost half of the patients with laryngeal disorders. Its role in patients with asthma is still underexplored.

Unlike GERD, LPRD is defined as the backflow of gastric contents into the laryngopharyngeal complex resulting in a constellation of atypical gastroesophageal symptoms, namely throat clearing, cough, globus pharyngeus and change in voice quality (6). Based on a PubMed literature review using words 'larynx', 'pharynx' and 'asthma', only three studies examining the prevalence of proximal reflux in patients with asthma were retrieved. By proximal reflux, we are referring to both laryngopharyngeal reflux (LPR) and high esophageal reflux disease as described by Komatsu *et al.* (7). In these studies, the authors have used validated questionnaires, flexible fiberoptic laryngoscopy, 24-h double probe pH monitoring and pharyngeal pH monitoring to diagnose proximal reflux. In the study by Kilic *et al.* (8), reflux symptoms questionnaire and 24-h double probe pH monitoring were used in 50 patients; however, no controls were enrolled and allergic rhinitis was not accounted for in the analysis as a confounding factor to laryngopharyngeal disease. Banaszkiwicz *et al.* (9) assessed the prevalence of LPR in 21 children with difficult to treat asthma. The subjects filled the Reflux Symptom Index (RSI) questionnaire and underwent 24-h pharyngeal pH monitoring. The investigation lacked a control group and allergy was not accounted for in data analysis. Komatsu *et al.* (7) performed a retrospective chart review on patients with adult-onset of asthma who underwent hypopharyngeal multichannel intraluminal impedance (HMII). The subjects were evaluated using upper endoscopy, esophagram, high-resolution manometry and 24-h HMII. The RSI questionnaire was not used in this study.

In all the aforementioned studies, the frequencies and severity of the laryngopharyngeal symptoms in comparison with a control group were not reported. The purpose of this investigation is to cast light on the prevalence and severity of laryngopharyngeal symp-

toms in asthmatic patients vs controls, taking into consideration the similarities of LPR symptoms to allergic symptoms and the confounding effect of allergy in patients with reflux. The role of LPRD as a comorbid disease to asthma is highlighted. Our hypothesis is that LPR symptoms are more severe and prevalent in patients with asthma vs controls.

Subjects and method

A total of 72 subjects were included in this study (36 were asthmatic and 36 were controls) matched according to age and gender. Asthmatic patients were recruited from the pulmonary clinic for evaluation. Patients were diagnosed with asthma based on the guidelines published by the Global Initiative for Asthma (GINA) (10) with the presence of characteristic symptoms of episodic breathlessness, wheezing, cough and chest tightness. The clinical assessment was made by the senior author of this manuscript. Control subjects were recruited by word of mouth and had no history of pulmonary disease. Subjects with vocal fold pathologies, recent history of upper respiratory tract infection or laryngeal manipulation were excluded from the study. All participants have signed the informed consent that was approved by the Institutional Review Board.

Demographic data included age, gender, status of the asthma (i.e. controlled vs uncontrolled), use of steroid inhalers, history of smoking and history of allergy. The control of disease was based on 'Asthma Control Test' a validated questionnaire mentioned in GINA report (10). Allergic rhinitis was evaluated using a standardized, validated questionnaire (11). In view of their confounding effect, the authors made sure that the prevalence of allergy and smoking were similar in both patients and controls. Demographic data included also the pulmonary function test, which was performed in 13 out of 36 asthmatic patients.

The evaluation of LPRD consisted of a self-administered questionnaire namely, the RSI described by Belafsky *et al.* (12). This latter consisted of the following nine symptoms: (i) hoarseness or problem of voice, (ii) clearing your throat, (iii) excessive throat mucus or postnasal drip, (iv) difficulty swallowing food, liquids or pills, (v) coughing after eating or lying down, (vi) breathing difficulties or choking episodes, (vii) troublesome or annoying cough, (viii) lump in throat or sticking sensation and (ix) heartburn, chest pain and indigestion. The symptoms were graded from 0 to 5, where 0 indicated no problem and 5 indicated severe problems. If total score was greater than 13, patients were diagnosed with LPRD (12). A symptom

was considered present if the score was above 1. The score for each question reflects the severity of the symptom, where 0 indicates absence of the symptom and 5 severe presence of the symptom. A *P* value of less than 0.05 was considered as statistically significant. In addition to looking at the prevalence of LPRD and its severity (by recording of the total score of RSI > 13 and the corresponding mean score in each subject), the authors have also looked at the frequency and average score of each of the laryngopharyngeal symptoms in both patients and controls. The RSI questionnaire was chosen because it is easily administered, highly reproducible and exhibits excellent construct criterion-based validity (12).

Descriptive analysis for the continuous variable (age) and categorical variables (gender, allergy, smoking and intake of steroid inhalers) were computed using mean and standard deviation. Independent sample *t*-test was used to compare means of the total RSI score and the nine reflux symptoms between the patients and controls. Independent sample *t*-test was also used to compare the above mean differences between the controlled and uncontrolled asthma patients. A *P* value of <0.05 was considered significant. Analyses were performed using Statistical Analysis Package for Social Sciences (SPSS, version 21.0 Chicago, IL, USA).

Results

Demographic data

The mean age of the patients was 46.61 ± 17.59 years with a female to male ratio of 2.3:1. Twenty patients were using steroid inhalers. Close to one third were smokers (30.6%) and 55.6% had allergy rhinitis. Thirty-six percent had controlled asthma vs 64% were uncontrolled. See Table 1.

Means of total RSI and prevalence of LPRD in patients and controls

The mean of Total RSI was significantly higher in patients compared with controls (12.03 ± 8.3 vs 6.64 ± 6.08 , *P* value < 0.05). Similarly, with respect to the frequency of LPRD (defined as RSI score > 13), 15 subjects in the asthmatic group had a positive RSI compared with only 4 in the control group, *P* value of 0.003. See Table 2.

Frequencies and means of LPR symptoms in patients and controls

The most frequent laryngopharyngeal symptoms in asthmatics were throat clearing (80.6%), excessive

Table 1. Demographics

	Patients (N = 36)	Controls (N = 36)
	Mean \pm SD	
Age	46.61 \pm 17.59	45.25 \pm 13.01
	N (%)	
Gender:		
Females	25 (69.4%)	25 (69.4%)
Males	11 (30.6%)	11 (30.6%)
Allergy	20 (55.6%)	15 (41.7%)
Smoking	11 (30.6%)	8 (22.2%)
Intake of Steroid Inhalers	20 (60.6%)	N/A
	Mean \pm SD	
Pulmonary function Test (N = 13)		N/A
• MPT	11.46 \pm 4.74	
• VC (Liter)	4.17 \pm 1.199	
• VC/MPT	0.33 \pm 0.109	
• FEV1 (Liter)	3.15 \pm 1.161	
• FEV1 (% of predicted)	97.38 \pm 22.787	
• FEV1/FVC (%)	74.22 \pm 13.733	

VC, vital capacity, the volume of air breathed out after the deepest inhalation; MPT, maximum phonation time; FEV1, forced expiratory volume, the maximal amount of air you can forcefully exhale in one second; FVC, forced vital capacity, the determination of vital capacity from a maximally forced expiratory effort; FEV1/FVC (%), the proportion of a person's vital capacity that they are able to expire in the first second of expiration. SD, standard deviation; N/A, not applicable.

throat mucus or postnasal drip (72%) and troublesome or annoying cough (69%). In the control group, the most common laryngopharyngeal symptoms were throat clearing (52.8%), followed by heartburn (47.2%) and sticking sensation in the throat (38.9%). There was a significant difference in the prevalence of four out of the nine laryngopharyngeal symptoms in patients vs controls (*P* value < 0.05). See Table 3.

Looking at the severity of the symptoms reflected by the means, there was a significant difference between the means of four laryngopharyngeal symptoms in patients vs controls (clearing your throat, excess throat

Table 2. Comparing means and frequencies of the total RSI score in patients vs controls

	Patients (N = 36)	Controls (N = 36)	<i>P</i> value
Mean RSI \pm standard deviation	12.03 \pm 8.3	6.64 \pm 6.08	0.003
Frequency of RSI	15 (41.7%)	4 (11.1%)	0.003

Table 3. Comparing means and frequencies of each of the laryngopharyngeal reflux symptoms in patients vs controls

	Means \pm standard deviation			Frequencies		
	Patients	Controls	<i>P</i> value	Patients	Controls	<i>P</i> value
Hoarseness or a problem with your voice	1.00 \pm 1.195	0.64 \pm 1.018	0.172	16 (44.4%)	12 (33%)	0.341
Clearing your throat	2.00 \pm 1.394	1.06 \pm 1.264	0.004	29 (80.6%)	19 (52.8%)	0.012
Excess throat mucus or postnasal drip	1.92 \pm 1.628	0.61 \pm 1.103	<0.05	26 (72.2%)	12 (33.3%)	0.001
Difficulty swallowing food, liquids or pills	0.53 \pm 0.810	0.50 \pm 0.887	0.889	12 (33.3%)	11 (30.6%)	0.804
Coughing after eating or lying down	0.75 \pm 1.228	0.36 \pm 0.961	0.139	14 (38.9%)	7 (19.4%)	0.071
Breathing difficulties or choking episodes	1.33 \pm 1.512	0.58 \pm 1.079	0.018	20 (55.6%)	10 (27.8%)	0.017
Troublesome or annoying cough	1.83 \pm 1.699	0.72 \pm 1.279	0.003	25 (69.4%)	11 (30.6%)	0.001
Sensations of something sticking in your throat or a lump in your throat	1.42 \pm 1.5	1.00 \pm 1.493	0.241	22 (61.1%)	14 (38.9%)	0.061
Heartburn, chest pain, indigestion or stomach acid coming up	1.25 \pm 1.360	1.17 \pm 1.612	0.813	20 (55.6%)	17 (47.2%)	0.486

mucus or postnasal drip, breathing difficulties or choking episodes, troublesome or annoying cough). See Fig. 1.

The mean and the frequency of the LPRD symptoms in asthmatic patients with allergic rhinitis were compared with those with no allergic rhinitis. The results of the analysis showed no significant difference in the means and frequency of all the LPRD symptoms, except for the frequency of one namely 'breathing difficulties or choking episodes'. This leads us to further conclude that rhinitis, as a confounding variable, was adequately accounted for in the design of this study (See Table 4).

Means of laryngopharyngeal symptoms in controlled vs uncontrolled asthma patients

There was no significant difference in the means and frequencies of any of the LPR symptoms in the con-

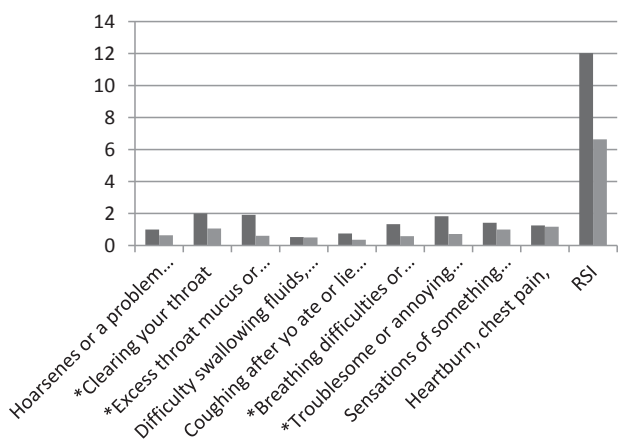


Figure 1. Means of Laryngopharyngeal symptoms in (■) asthmatic patients vs (■) controls. *Significantly different means in patients vs controls.

trolled vs uncontrolled asthmatic patients except for hoarseness (*P* value of 0.02). See Table 5. In comparing the controlled asthma group with controls, there was a significant difference in the means and frequencies of three LPR symptoms, namely hoarseness, excess throat mucus and annoying cough (*P* value < 0.05). See Table 6. With respect to the uncontrolled asthma group, there were still significant differences in the prevalence and means of four LPR symptoms (*P* value < 0.05). See Table 7.

Discussion

LPRD is a disease described by Koufman (5, 13) as retrograde movement of refluxate material into the pharynx and larynx. Unlike GERD, the pathophysiology lies in the upper esophageal sphincter with or without impairment in esophageal mobility. Despite the fact that LPRD falls within the spectrum of GERD, the clinical presentation of this disease remains different (5, 13). Patients lack the typical symptoms of heartburn and regurgitation and instead present with change in voice quality, throat clearing, globus sensation, cough and excessive phlegm (5, 13). The laryngeal findings can be subtle and often misleading, with posterior laryngitis and mucosal edema being most common. Given the nonspecific laryngeal findings, LPRD is often under diagnosed and thus may carry significant comorbidity in patients in general including asthmatic patients.

Despite the importance to control LPRD in optimizing the treatment of asthma, there are not many reports on the true prevalence of LPRD in patients with asthma. There are numerous studies in the literature on GERD as a comorbid condition to asthma and only few studies recently published have addressed the issue of proximal, i.e., hypopharyngeal reflux disease (7–9, 14). These studies have relied on

Table 4. Comparing means and frequencies of each of the laryngopharyngeal reflux symptoms in patients who are positive for allergic rhinitis vs patients who are negative for allergic rhinitis

	Means \pm standard deviation			Frequencies		
	Positive allergic rhinitis ($N = 20$)	Negative allergic rhinitis ($N = 16$)	P value	Positive allergic rhinitis ($N = 20$)	Negative allergic rhinitis ($N = 16$)	P value
Hoarseness or a problem with your voice	0.95 \pm 1.234	1.06 \pm 1.181	0.784	8 (40%)	8 (50%)	0.562
Clearing your throat	2.10 \pm 1.619	1.88 \pm 1.088	0.637	15 (75%)	14 (87.5%)	0.361
Excess throat mucus or postnasal drip	2.10 \pm 1.889	1.69 \pm 1.250	0.438	13 (65%)	13 (81.3%)	0.282
Difficulty swallowing food, liquids or pills	0.45 \pm 0.826	0.63 \pm 0.806	0.527	5 (25%)	7 (43.8%)	0.257
Coughing after eating or lying down	0.65 \pm 1.226	0.88 \pm 1.258	0.592	7 (35%)	7 (43.8%)	0.605
Breathing difficulties or choking episodes	1.60 \pm 1.501	1.00 \pm 1.506	0.242	14 (70%)	6 (37.5%)	0.053
Troublesome or annoying cough	2.00 \pm 1.919	1.63 \pm 1.408	0.504	14 (70%)	11 (38.8%)	0.938
Sensations of something sticking in your throat or a lump in your throat	1.65 \pm 1.694	1.13 \pm 1.204	0.303	12 (60%)	10 (62.5%)	0.883
Heartburn, chest pain, indigestion or stomach acid coming up	1.50 \pm 1.539	0.94 \pm 1.063	0.205	12 (60%)	8 (50%)	0.562

one of several diagnostic tools, namely indirect laryngoscopy, double probe pH metry and or hypopharyngeal intraluminal impedance techniques and last but not least the RSI questionnaire. The severity and frequency of the laryngopharyngeal symptoms were not compared with a control group in any of these studies. In view of the limited availability of pH meter in several medical institutions and the need for radiological imaging to ascertain the location of the probe when used, the authors of this manuscript have elected to use the RSI questionnaire described by Belafsky *et al.* (12). Because of the nonspecific nature

of many of the laryngopharyngeal symptoms and their similarities to allergic rhinitis symptoms, we made sure that the prevalence of allergic rhinitis and smoking were similar in both patients and controls.

The results of our investigation are in alignment with previous reports indicating a higher prevalence rate of LPRD in asthmatics compared with controls (P value of 0.003). More so, the mean of the RSI score in the asthma group is significantly higher than that of the control group (12.30 vs 6.64, P value of 0.003). In looking at the means and frequencies of LPR symptoms, four out of the nine were significantly more

Table 5. Comparing means and frequencies of each of the laryngopharyngeal reflux symptoms in controlled vs uncontrolled asthma

	Means \pm standard deviation			Frequencies		
	Controlled asthma	Uncontrolled asthma	P value	Controlled asthma	Uncontrolled asthma	P value
Hoarseness or a problem with your voice	1.54 \pm 1.127	0.71 \pm 1.189	0.1	9 (69.2%)	6 (28.6%)	0.02
Clearing your throat	1.85 \pm 1.463	2.00 \pm 1.378	0.839	10 (76.9%)	17 (81%)	0.778
Excess throat mucus or postnasal drip	1.92 \pm 1.801	1.90 \pm 1.640	0.934	9 (69.2%)	15 (71.4%)	0.891
Difficulty swallowing food, liquids or pills	0.62 \pm 0.87	0.52 \pm 0.814	0.76	5 (38.5%)	7 (33.3%)	0.761
Coughing after eating or lying down	0.85 \pm 1.519	0.62 \pm 1.071	0.683	4 (30.8%)	8 (38.1%)	0.664
Breathing difficulties or choking episodes	1.23 \pm 1.423	1.52 \pm 1.601	0.202	7 (53.8%)	13 (61.9%)	0.643
Troublesome or annoying cough	1.69 \pm 1.75	1.86 \pm 1.769	0.833	8 (61.5%)	15 (71.4%)	0.549
Sensations of something sticking in your throat or a lump in your throat	1.23 \pm 1.423	1.48 \pm 1.601	0.838	7 (53.8%)	13 (61.9%)	0.643
Heartburn, chest pain, indigestion or stomach acid coming up	1 \pm 1.354	1.43 \pm 1.399	0.237	6 (46.2%)	13 (61.9%)	0.369

Table 6. Comparing means and frequencies of each of the laryngopharyngeal reflux symptoms in controlled asthma vs the control group

	Means \pm standard deviation			Frequencies		
	Controlled asthma	Control	<i>P</i> value	Controlled asthma	Control	<i>P</i> value
Hoarseness or a problem with your voice	1.54 \pm 1.127	0.64 \pm 1.018	0.011	9 (69.2%)	12 (33.3%)	0.025
Clearing your throat	1.85 \pm 1.463	1.06 \pm 1.264	0.070	10 (76.9%)	19 (52.8%)	0.116
Excess throat mucus or postnasal drip	1.92 \pm 1.801	0.61 \pm 1.103	0.026	9 (69.2%)	12 (33.3%)	0.025
Difficulty swallowing food, liquids or pills	0.62 \pm 0.870	0.50 \pm 0.878	0.686	5 (38.5%)	11 (30.6%)	0.611
Coughing after you ate or lie down	0.85 \pm 1.519	0.36 \pm 0.961	0.298	4 (30.8%)	7 (19.4%)	0.412
Breathing difficulties or choking episodes	1.23 \pm 1.423	0.58 \pm 1.079	0.096	7 (53.8%)	10 (27.8%)	0.094
Troublesome or annoying cough	1.69 \pm 1.750	0.72 \pm 1.279	0.039	8 (61.5%)	11 (30.6%)	0.051
Sensations of something sticking in your throat or a lump in your throat	1.23 \pm 1.423	1.00 \pm 1.493	0.631	7 (53.8%)	14 (38.9%)	0.361
Heartburn, chest pain, indigestion or stomach acid coming up	1.00 \pm 1.354	1.17 \pm 1.612	0.741	6 (46.2%)	17 (47.2%)	0.949

frequent and severe in the asthmatic group compared with controls (with *P* values < 0.05). This was also evident when the asthmatic patients were stratified into controlled and uncontrolled.

Komatsu *et al.* (7) has shown that despite a frequently negative DeMeester score, abnormal hypopharyngeal exposure can occur in up to 70% of patients with asthma. The study was conducted on 27 asthmatic patients and hypopharyngeal intraluminal impedance was used to assess the pattern and proximity of the reflux events. In Kilic *et al.*'s (8) prospective study to determine the prevalence of LPR and GER in patients with asthma, 70% had LPR compared with 46% who had GER. In their study, the reflux symptom score failed to predict LPR and GER as documented by double probe pH monitoring. Nevertheless, it is worth noting two important issues in the study: one is the

very high prevalence of atopy in the overall subject group (70% and 65% in both subgroups), which can markedly mask the LPR symptoms and reduce the significant prevalence of these symptoms among the two groups; another is the significant and markedly higher prevalence of LPR symptoms evident by the RSI > 13 (29.6% vs 78.3%, *P* value of 0.001) in the uncontrolled asthmatic group vs the controlled group. This finding substantiates the strong association between asthma and LPR and indicates that this latter is a comorbid condition to asthma.

In a study by Eryuksel *et al.* (14) on the prevalence of LPRD in asthma, 75% had evidence of LPRD by indirect laryngoscopy, the treatment of which improved the asthma condition.

In partial agreement with previous reports indicating that the prevalence of LPRD in asthmatic patients

Table 7. Comparing means and frequencies of each of the laryngopharyngeal reflux symptoms in uncontrolled asthma vs the control group

	Means \pm standard deviation			Frequencies		
	Uncontrolled asthma	Control	<i>P</i> value	Uncontrolled asthma	Control	<i>P</i> value
Hoarseness or a problem with your voice	0.71 \pm 1.189	0.64 \pm 1.018	0.801	6 (28.6%)	12 (33.3%)	0.715
Clearing your throat	2.00 \pm 1.378	1.06 \pm 1.264	0.011	17 (81.0%)	19 (52.8%)	0.025
Excess throat mucus or postnasal drip	1.90 \pm 1.640	0.61 \pm 1.103	0.003	15 (71.4%)	12 (33.3%)	0.005
Difficulty swallowing food, liquids or pills	0.52 \pm 0.814	0.50 \pm 0.878	0.920	7 (33.3%)	11 (30.6%)	0.831
Coughing after eating or lying down	0.62 \pm 1.071	0.36 \pm 0.961	0.353	8 (38.1%)	7 (19.4%)	0.153
Breathing difficulties or choking episodes	1.52 \pm 1.601	0.58 \pm 1.079	0.023	13 (61.9%)	10 (27.8%)	0.011
Troublesome or annoying cough	1.86 \pm 1.769	0.72 \pm 1.279	0.015	15 (71.4%)	11 (30.6%)	0.002
Sensations of something sticking in your throat or a lump in your throat	1.48 \pm 1.601	1.00 \pm 1.493	0.263	13 (61.9%)	14 (38.9%)	0.096
Heartburn, chest pain, indigestion or stomach acid coming up	1.43 \pm 1.399	1.17 \pm 1.612	0.538	13 (61.9%)	17 (47.2%)	0.293

varies with the degree of the disease and the number of exacerbation events, our study showed no significant difference in the prevalence of any of LPRD symptoms in the controlled vs uncontrolled group except for one. This is in line with a study by Aras *et al.* (15) on 60 asthmatic patients showing that aside from regurgitation and heartburn, dysphagia was the only GERD symptom influencing pulmonary function testing. On the other hand, in the prospective study by Banaszkiwicz *et al.* (9) on 21 patients with asthma, there was a positive correlation between LPR and degree of asthma control, further substantiating the need to know the prevalence of this comorbid condition and the need to treat in order to achieve better control.

There are many explanations to the higher prevalence of LPRD in patients with asthma and its correlation with this lower airway disease. Several hypotheses have been described in the literature. One is vagal nerve stimulation as a result to the esophageal exposure to the refluxate material, acid and pepsin (16). A second basis for the higher prevalence of LPRD in asthmatics is the direct exposure of the trachea, bronchi and lungs to the refluxate material leading to bronchoconstriction. With the absence of the defense mechanism for protection of the upper and lower airways, namely the presence of peristalsis and cilia, the trachea-bronchial tree are exposed to the possible aspiration of the refluxate material (16–18). A third basis is the attenuation of the pharyngocricopharyngeal reflex by the reflux leading to its weakness and inability to contract and protect the upper airway (19–21). Our study is the first study to examine the severity and frequency of LPR symptoms in patients with asthma vs controls taking into consideration the confounding effect of allergic rhinitis as a confounding factor. Nevertheless, it has one main limitation and that is the lack of pharyngeal or double probe pH metry to document LPRD. This limitation is primarily due to the lack of availability of this diagnostic test in the facility where the study was conducted.

Conclusion

LPRD is more prevalent and severe in patients with asthma compared with controls. The frequency and severity of many LPR symptoms are more pronounced in asthmatic subjects, more so in those with uncontrolled disease. This mandates proper attention and treatment to LPRD as a comorbid condition to asthma.

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