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Role of History Taking in Differential Diagnosis of Small Airway Disease: A Pilot Study on 32 Cases

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Abstract

Objectives: Since history taking is still the most important part of a medical diagnosis, we tried to find sensitive and specific symptoms and risk factors in order to differentiate small airway disease from other pulmonary diseases. Social factors as well as related past medical history including using spirits of salt (HCL), gastro-esophageal reflux disease (GERD) and so on were evaluated.

Materials and Methods: The present pilot study consists of 32 cases of small airway disease and 28 cases of other pulmonary diseases. The statistical evaluations were performed through 2 × 2 tables using Fisher exact test adjusted with Bonferroni correction for P values and Yate correction for odds ratios. The sensitivities and the specificities were also reported as we aimed.

Results: Among the 4 symptoms evaluated, having sputum was against small airway disease ($Pc = 0.0184$; $ORc = 0.23$). Lack of sputum was 62% sensitive and 75% specific for small airway disease. Among the risk factors evaluated, using HCL showed the highest accuracy ($Pc = 0.0004$; $ORc = 31.4$; Sensitivity = 65%; Specificity = 96%; Accuracy = 80.5%). History taking is still the most important part of a medical diagnosis.

Conclusions: Through a suggestive history and physical examination, we can reach a good pretest probability for further evaluation.

Keywords: Small airway disease, Pulmonary disease, COPD, Medical history

Introduction

Small airways are the airways with an internal diameter less than 2 mm. These airways are located approximately in the region of the eighth generation airways (1). Tidal airway closure and expiratory flow limitation cause small airways disease (2). This term was introduced by Hogg et al in the 1960s. Patients with small airway disease had chronic airflow limitation, inflammation, airway narrowing and mucus plug formation. There is some evidence that in the small airways of cigarette smokers, inflammatory changes are common, but not necessarily resulting in emphysema and chronic bronchitis which are usually the cause of the clinical condition of chronic airflow obstruction. The tests of small airways function appear to be quite sensitive for early detection of airflow obstruction (3).

The differential diagnosis of small airway diseases (also called as chronic bronchiolitis), asthma and chronic obstructive pulmonary diseases (COPD) is important. Inflammatory cells in bronchioles are involved in the physiopathology of small airway disease. Additionally, it can be diagnosed through imaging techniques like computed tomography (CT) scan (1). Since history taking is still the most important part of a medical diagnosis, we tried to find sensitive and specific symptoms and risk factors in order to differentiate small airway disease from other pulmonary diseases. The evaluated symptoms were cough, sputum, dyspnea and wheezing (not as a sign in auscultation) as four common and easy to find symptoms. Social factors as well as related past medical history including using spirits of salt (HCL) (for example in home washing), gastro-esophageal reflux disease (GERD), having an open kitchen, and bread baking were evaluated. The 2 last ones (open kitchen and bread baking) were considered because of the traditional structure and culture of Lorestan province, west of Iran.

Materials and Methods

The present pilot study consists of 32 cases of small airway disease and 28 cases of other pulmonary diseases. The samples have been collected through convenient sampling in Khorramabad, a city in west of Iran, during 2016. The confirmation of small airway disease was through para-clinical evaluations (4,5). We diagnosed our samples through high-resolution CT scan (HRCT) in both deep

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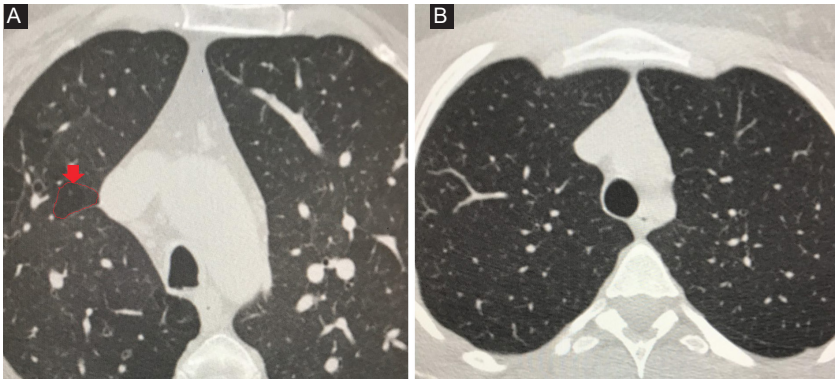

Figure 1. Parenchimal View of HRCT Scan. (A) Air trapping in a patient with small airway disease (expiration). (B) Normal pattern.

inspiration and deep expiration and air trapping (Figure 1 and Supplementary materials online, Video S1), as well as using forced expiratory flow at 25-75% (FEF25/75) in spirometry.

In order to find sensitive and specific symptoms and risk factors for small airway disease, the evaluated symptoms were cough, sputum, dyspnea and wheezing as four common and easy to find symptoms. Social factors and past medical history including using HCL, GERD, having an open kitchen, and bread baking were evaluated. In other words, we tried to find a way of screening for the disease through history taking instead of para-clinical evaluations (Figure 2). However, the para-clinical evaluations are still necessary for the confirmation of the diagnosis.

The statistical evaluations were performed through 2 × 2 tables using Fisher exact test adjusted with Bonferroni correction (two 4-test multiple evaluation packages; a 4-test evaluation for symptoms, and a 4-test evaluation for associated factors). The odds ratios (OR) were corrected and adjusted using Yate correction [(a-0.5) (d-0.5) / (b+0.5) (c+0.5); if OR>1 & (a+0.5) (d+0.5) / (b-0.5) (c-0.5); if OR<1]. The sensitivities and the specificities were also reported as we aimed.

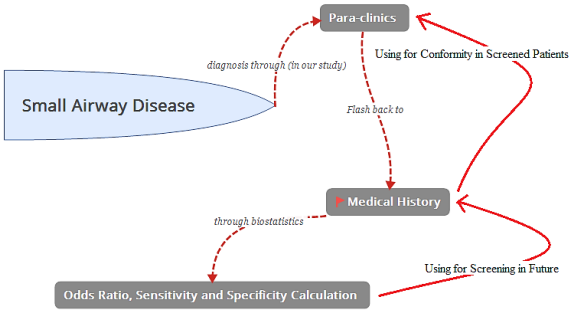

Figure 2. Our Aim and Approach in This Pilot Study.

Results

Among the 4 symptoms evaluated, having sputum was against small airway disease ($P=0.0184$; OR = 0.23 [corrected]). There was no statistically significant difference among cough, wheezing and dyspnea ($P>0.05$). Among the 4 risk factors evaluated, all of them were statistically significant at first, but after applying Bonferroni correction the factor of bread baking did not remain significant. Having GERD was significantly associated with small airway disease ($P=0.0276$; OR=7.45

Table 1. Associated symptoms and risk factors of small airway disease in comparison with other pulmonary patients

Variable	Small Airway Disease		Other Pulmonary Patients		*P* Value	*Pc* Value	ORc
	Positive	Negative	Positive	Negative			
Symptom							
Cough	22	10	25	3	0.0665	NS	NA
Sputum	12	20	21	7	0.0046	0.0184[a]	0.23
Dyspnea	29	3	21	7	0.1655	NS	NA
Wheezing	13	19	14	14	0.6039	NS	NA
Risk factors							
Open kitchen	24	8	6	22	0.0001	0.0004[b]	9.14
Bread baking	3	29	9	19	0.0498	NS	NA
GERD	10	22	1	27	0.0069	0.0276[a]	7.45
HCL	21	11	1	27	0.0001	0.0004[b]	31.4

P_c value is the corrected P value based on Bonferroni correction (2 numbers of 4-test multiple evaluation). OR_c is the corrected odds ratio based on Yate's correction. NS: non-significant. NA: not applicable.

[a] Significant at 0.05; [b] Significant at 0.001.

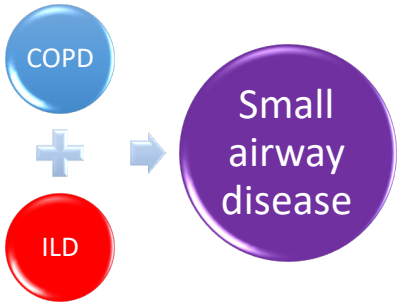

Figure 3. Small airway disease can be defined as overlap of COPD and ILD.

[corrected]) as well as using HCL ($P=0.0004$; OR= 31.4 [corrected]). Having open kitchen was also associated with small airway disease ($P=0.0004$; OR=9.14 [corrected]), however, this finding is not generalizable to other populations because of the traditional structure and culture of our province (Table 1).

In order to evaluate medical diagnosis accuracy, we calculated sensitivities and specificities. Among the symptoms, lack of sputum was 62% sensitive and 75% specific for small airway disease (68.5% accuracy). The sensitivity and specificity of having an open kitchen in such traditional populations were 75% and 78%, respectively for small airway disease (76.5% accuracy).

Table 2. Sensitivity and Specificity of the Significant Variables of Table 1

Variable	*Pc* Value	ORc	Medical Diagnosis Accuracy	
			Sensitivity	Specificity
Symptom				
Cough	NS	NA	NA	NA
Lack of sputum	0.0184[a]	4.26	62%	75%
Dyspnea	NS	NA	NA	NA
Wheezing	NS	NA	NA	NA
Risk factors				
Open kitchen	0.0004[b]	9.14	75%	78%
Bread baking	NS	NA	NA	NA
GERD	0.0276[a]	7.45	31%	96%
HCL	0.0004[b]	31.4	65%	96%

[a] Significant at 0.05.
[b] Significant at 0.001.

Table 3. Different conditions of having or not having cough and sputum

Cough	Sputum	SAD	OPP	*P* value	*Pc* value	ORc
		11	20	0.0052	0.0204[a]	0.24
		11	5	0.2417	NS	NA
		1	1	1	NS	NA
		9	2	0.0479	NS	NA

Abbreviations: SAD, small airway disease. OPP, other pulmonary patients. Blue cells show having the symptom.
[a] Significant at 0.05.

The sensitivity and specificity of having GERD were 31% and 96%, respectively for small airway disease (63.5% accuracy). The sensitivity and specificity of using HCL were 65% and 96%, respectively for small airway disease (80.5% accuracy) (Table 2).

Based on different conditions of having or not having cough and sputum, having both cough and sputum simultaneously, was significantly against small airway disease ($P=0.0204$; OR=0.23; corrected) (Table 3).

Discussion

This study was aimed to emphasize the role of medical history in differential diagnoses of each patient. Although the topic of small airway disease is not novel, however, the number of papers was few. In other words, although using the phrase "small airway disease" in titles dates back to 1967 (6), the total number of papers is still rare.

Based on the present study, exposure to HCL had the highest accuracy in the history of patients with small airway disease. Regarding the role of toxic gases inhalation, a study done on the victims of Bhopal tragedy showed 7% prevalence of small airway disease in 129 samples of individuals exposed to toxic gas in the disaster (7). Toxic vapors can penetrate deep into small airways. We consider HCL vapors as one of them. Moreover, we hypothesize that the role of GERD as a risk factor can be justified through the inhalation of gastric acid vapors. A review article believes that micro-aspiration of gastric contents can cause damage to small airways (8). In 2009, Rice and Nicholson discussed the histopathology of small airway disease in a review paper. They believed that bronchiolitis was related to interstitial lung diseases (ILD) (9). Hence, small airway disease can be put into both COPD and ILD categories (Figure 3). Some others believe that small airway disease can progress to overt COPD (2). Further information is available in another review article written in 2013 (1). The novelty of our study was to investigate the association of using HCL and small airway disease. For this association, we found no evidence in scientific databases and search engines.

Recently, the co-association of small airway disease and immune-related diseases like inflammatory bowel disease has been investigated (10). The immune and inflammatory bases of small airway disease can be a good justification for the common point existing between COPD and ILD. Local lymphocyte infiltration in interstitial tissues of the lung can cause both obstructive and restrictive signs and symptoms.

The main limitation of our study was our small sample size. Some points should be regarded in the interpretation of our results.

1. The mentioned wheezing was merely regarded as a symptom (not as a sign in auscultation). In other words, we were trying to show the role of medical history without a physical exam.

2. Medical history (from chief complaint to review of systems) gave us a clue for the physical examination. In the next level, history and physical examination together increased the pretest probability for para-clinical evaluations.
3. The mentioned sensitivities, specificities and accuracies have been calculated based on the pulmonary complaint and a history of the present illness.
4. Other chemical and toxic inhalations should be regarded in history taking.

Conclusions

History taking is still the most important part of a medical diagnosis. Through a suggestive history and physical examination, we can reach a good pretest probability for further evaluation. Further investigations are needed for associated factors, results of auscultation in physical examination and para-clinical data.

Supplementary Materials

Video S1. HRCT scan of lung with air trapping in small airway disease.

Conflict of Interests

Authors declare that they have no conflict of interests.

Ethical Issues

This manuscript is a part of a research project in Lorestan University of Medical Sciences with ethics code: LUMS. REC.1395.90. Based on the ethical consideration, we were supposed not to disclose the personal information of the patients.

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