

ORIGINAL ARTICLE

Allergic laryngitis as a cause of dysphonia: a preliminary report

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Abstract

Objectives. To investigate the relationship between air-borne allergen exposure and Voice Handicap Index scores in patients seeking medical treatment for rhinitis. **Methods.** As we had previously identified a higher-than-expected incidence of allergy in patients presenting to a voice clinic, we undertook a prospective audit of patients without specific voice-related complaints presenting to a rhinology clinic to see if these patients might have unrecognized vocal dysfunction. To this end 70 consecutive patients with no pre-reported voice-related symptoms presenting to a teaching hospital rhinology clinic underwent skin prick testing to common air-borne allergens and completed the Voice Handicap Index (VHI) questionnaire. Discriminant performances in the Voice Handicap Index and its individual domains and questions were determined using analysis of variance. An allergy-specific subset of the VHI was constructed and tested using receiver operating characteristic (ROC) statistics. **Results.** There were 30 males and 40 females. Mean age was 36 ± 12 years. Dust mite (83%), house dust mite (55%), and grass pollen (40%) were the commonest allergens, and 23 patients did not react to common allergens. Mean VHI score was 23.7 ± 20.1 in patients with ≥ 4 allergens, 10.8 ± 21.3 in patients with fewer than 4 allergies, and 7.8 ± 8.5 in non-allergics ($P = 0.044$; analysis of variance). Nine VHI questions best discriminated between allergic and non-allergic patients ($P < 0.05$), and the combined VHI-9 score had a ROC area under the curve of 0.85. **Conclusions.** Patients with more air-borne allergies have a higher incidence of undiagnosed vocal dysfunction, as determined by the raised Voice Handicap Index score, than those with fewer or no such allergies. As noted, earlier work has shown that, conversely, patients with vocal dysfunction have a high incidence of undiagnosed allergy.

Key words: Allergy, dysphonia, laryngitis, rhinitis

Introduction

Upper aerodigestive tract allergy commonly manifests as allergic rhinitis (1). It can cause laryngeal oedema and lead to the production of heavier and more tenacious mucous (2). These in turn could cause dysphonia.

There is a small body of evidence to suggest that 'allergic laryngitis' can be a potential cause of hoarseness and throat symptoms that can be misattributed to laryngopharyngeal reflux (3). We have previously noted a higher-than-expected incidence of undiagnosed allergy in patients presenting with hoarseness (3). Simberg and colleagues have found a high incidence of vocal symptoms in patients undergoing immunotherapy for air-borne allergens (4). However, allergic laryngitis is still an under-researched and poorly understood entity, and it is likely that many allergy sufferers may ignore the finding of sticky mucous on the larynx or attribute it to other allergic

manifestations, in particular those related to the nose.

The main objective of the present study was to investigate patients with no specific voice-related complaints presenting to a rhinology clinic, to assess if the degree of atopy (as determined by the number of common allergens reacted to on routine skin prick test) correlated with total and subset scores on a validated voice questionnaire (the Voice Handicap Index). A secondary objective was to assess if a subset of this questionnaire might more specifically identify individuals with atopic related voice dysfunction.

Materials and methods

Patient and demographic data

This was a cross-sectional audit of vocal symptoms in patients presenting to a rhinology clinic at the

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Royal National Throat Nose and Ear Hospital for which clinical and demographic data were retrospectively obtained from patient records.

Skin prick testing (SPT)

All patients underwent skin prick testing to confirm allergy to common air-borne allergens. The array of allergens tested for included house dust, dust mite, aspergillus, cladosporium, grass pollen, feathers, cat, silver birch, trees, and dog, and the severity of the allergic reaction was graded according to the Tripathi-Patterson system (5). Based on SPT findings allergy severity was stratified into three groups: 1) patients not allergic to any of the common allergens tested for, 2) patients allergic to fewer than four common allergens, and 3) patients with allergies to four or more common air-borne allergens.

Assessment of vocal symptoms

The Voice Handicap Index (VHI), which is a validated 30-item patient-administered vocal questionnaire (6) and has been routinely used in voice and general otolaryngology clinics at our institution since January 2008, was added to the array of patient-administered instruments completed by all patients.

Data analysis

Continuous and categorical variables were expressed as means with standard deviations and percentages, respectively. The relationship between severity of allergy and vocal symptoms was assessed using total and domain-specific VHI scores. The utility of individual VHI questions to discriminate between allergic and non-allergic patients was tested using analysis of variance, and the scores of the discriminating questions were combined to form a new composite score. The ability of this composite score to differentiate between poly-allergic and non-/oligo-allergic patients was tested using receiver operating characteristic (ROC) statistics. Data were analysed and illustrated using MedCalc (Mariakerke, Belgium), and $P < 0.05$ was considered significant.

Results

Patient and allergen characteristics

There were 30 males (43%) and 40 females. Mean age at presentation was 36 ± 12 years ($\pm$ SD). None of the patients had been referred from a voice clinic or had sought medical attention for vocal symptoms. A total of 23 patients with a positive histamine control

did not show an allergic response to the common allergens tested, and among the remaining 47 patients dust mite (83%), house dust mite (55%), and grass pollen (40%) were the commonest allergens. Table I provides further details about patient demographics and allergens.

Allergy-related vocal dysfunction

The mean VHI score in patients with ≥ 4 air-borne allergens was 23.7 ± 20.1 . In patients with fewer than 4 allergens the VHI score was 10.8 ± 21.3 , and in non-allergic patients it was 7.8 ± 8.5 . The difference between the groups reached statistical significance ($P = 0.044$; analysis of variance). Statistically significant differences were also observed between the physical (P) and emotional (E) but not functional (F) domains of the VHI scale. These findings are illustrated in Figure 1.

Discriminant analysis of VHI questions in allergic laryngitis

Table II provides details of the discriminant capacity of individual VHI questions to differentiate between patients with significant allergies and those without. Performance on nine questions (P_2 , P_3 , P_4 , P_6 , P_9 , E_1 , E_3 , E_4 , and E_6) reached statistical significance ($P < 0.05$; analysis of variance). The scores of these questions were combined into a nine-item questionnaire (VHI-9). It had greater discriminant ability than total or domain-specific VHI scores (F -ratio 8.60; $P < 0.001$). The area under the ROC curve for VHI-9 was 0.85 ± 0.07 , confirming a high discriminant ability for this subscale of the VHI (Figure 2).

Discussion

The findings of this study suggest that amongst patients with air-borne allergy seeking medical treatment for rhinitis, the degree of allergen load correlates with the severity of vocal symptoms as demonstrated by an increase in score on the VHI. These findings add further support to the notion of 'allergic laryngitis' (7) as a cause of dysphonia.

The VHI is a validated questionnaire (6) assaying physical, functional, and emotional subsets of vocal dysfunction and has been in clinical use for over a decade. The questionnaire is routinely used in all of our voice and general otolaryngology clinics. It is also used by our speech and language therapy colleagues at the Royal National Throat Nose and Ear Hospital to help in determination of the urgency of a speech therapy appointment as well as to assess progress of treatment, be it medical or surgical. Consequently, it

Table I. Demographic and allergen data of patients presenting with symptoms of allergic rhinitis to a specialist rhinology/allergy clinic.

	No allergens	<4 allergens	≥4 allergens
Number of cases	23	35	12
Male sex (%)	13 (57%)	13 (37%)	4 (33%)
Mean age ± SD (range)	36.6 ± 12 (16–66)	36.6 ± 11.9 (18–79)	33.5 ± 14 (20–73)
Common air-borne allergens tested:			
Dust mite	–	27 (77%)	12 (100%)
House dust mite	–	14 (40%)	12 (100%)
Grass pollen	–	8 (23%)	11 (92%)
Cladosporium	–	6 (17%)	0
Trees	–	4 (11%)	6 (50%)
Birch	–	2 (6%)	6 (50%)
Dog	–	2 (6%)	6 (50%)
Cat	–	2 (6%)	5 (42%)
Aspergillus	–	3 (9%)	1 (8%)
Feathers	–	3 (9%)	1 (8%)

was the questionnaire of choice in this study. It is easy to complete, taking less than 5 minutes. Other questionnaires such as the SF-36 (The Short Form (36) Health Survey) could have been used, but many are less specific for voice related issues.

It is important to note that in our study, none of our patients had pre-reported voice symptoms or were referred from a voice clinic and yet had symptoms of vocal dysfunction as identified from the VHI. We know that in voice production the nasal cavity acts as a resonator, and any alteration to this may cause dysphonia (8). This may explain why this group of patients who have upper airway inflammation as a consequence of allergy has higher incidence of

vocal dysfunction (4). This can subsequently be translated to the VHI findings, which is a patient-centred voice questionnaire.

Another possible explanation is that the morbidity-associated allergy may have influenced the self-evaluation of vocal dysfunction. Allergic rhinitis has also been shown to have a significant impact on patients' social lives, work productivity, and learning performances (9). It is the most common chronic condition in adult populations, affecting 10% to 30% (10). Approximately half the patients with allergic rhinitis experience symptoms for more than 4 months each year, and 20% are symptomatic for at least 9 months of the year for adults (11). This generalized

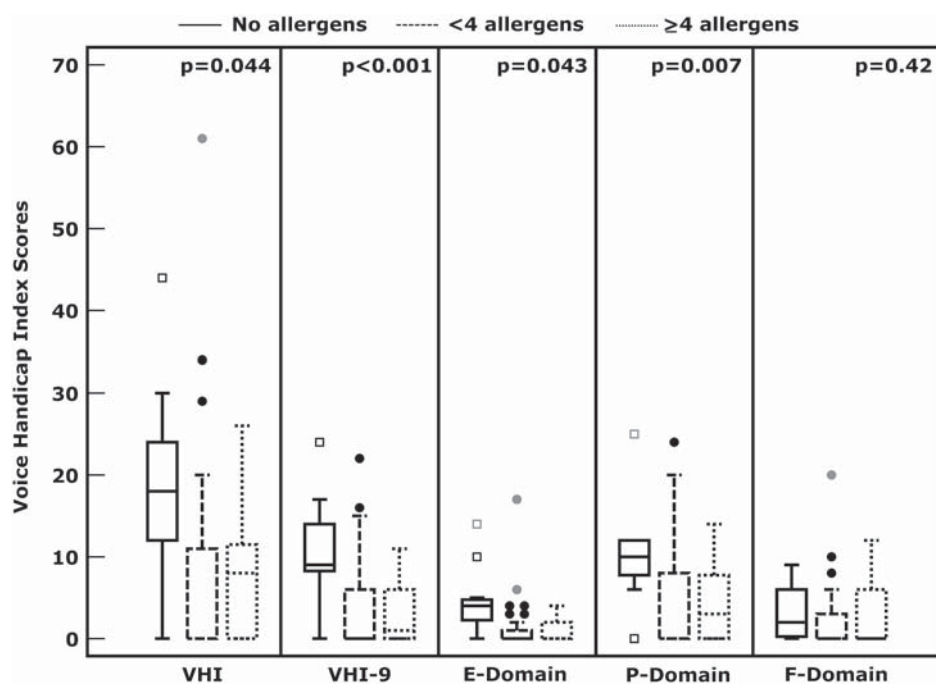


Figure 1. Box-and-whisker plots of the total, domain-specific (P, F, and E) and allergy-specific (VHI-9) scores of the Voice Handicap Index plotted as functions of the severity of air-borne allergy in patients with suspected allergic rhinitis and without pre-reported vocal symptoms. (P = physical; F = Functional; E = emotional.)

Table II. Voice Handicap Index scores as a function of the severity of air-borne allergy. The total score of the nine questions highlighted in bold which significantly discriminated between patients with and without allergy were combined to form the VHI-9 score.

Voice Handicap Index Questions	Severity of allergy			P-value ^a
	No allergens <i>n</i> = 24	<4 allergens <i>n</i> = 35	≥4 allergens <i>n</i> = 12	
Functional Domain:				
F ₁ : My voice makes it difficult for people to hear me	0.42 ± 0.71 ^b	0.34 ± 0.80	0.92 ± 0.90	0.10
F ₂ : People have difficulty understanding me in a noisy room	0.83 ± 1.00	0.80 ± 1.18	1.33 ± 1.37	0.37
F ₃ : My family has difficulty hearing me when I call them throughout the house	0.71 ± 1.00	0.31 ± 0.76	0.75 ± 1.06	0.17
F ₄ : I use the phone less often than I would like	0.38 ± 1.01	0.20 ± 0.76	0.33 ± 0.89	0.73
F ₅ : I tend to avoid groups of people because of my voice	0.21 ± 0.66	0.20 ± 0.76	0.42 ± 1.00	0.68
F ₆ : I speak with friends, neighbours, or relatives less often because of my voice	0.21 ± 0.66	0.20 ± 0.76	0.33 ± 0.89	0.86
F ₇ : People ask me to repeat myself when speaking face-to-face	0.46 ± 0.78	0.37 ± 0.91	0.58 ± 1.00	0.77
F ₈ : My voice difficulties restrict my personal and social life	0.17 ± 0.64	0.23 ± 0.77	0.25 ± 0.87	0.93
F ₉ : I feel left out of conversation because of my voice	0.13 ± 0.34	0.20 ± 0.63	0.33 ± 0.89	0.62
F ₁₀ : My voice problem causes me to lose income	0.00 ± 0.00	0.17 ± 0.61	0.25 ± 0.87	0.37
Physical Domain:				
P ₁ : I run out of air when I talk	0.39 ± 0.84	0.29 ± 0.75	0.67 ± 0.98	0.39
P₂: The sound of my voice varies throughout the day	0.39 ± 0.72	1.09 ± 1.29	2.12 ± 1.27	<0.001
P₃: People ask, ‘What’s wrong with your voice?’	0.17 ± 0.48	0.26 ± 0.82	1.00 ± 1.28	0.016
P₄: My voice sounds creaky and dry	0.91 ± 1.16	0.91 ± 1.31	2.08 ± 1.24	0.017
P ₅ : I feel as though I have to strain to produce voice	0.30 ± 0.56	0.43 ± 0.95	0.92 ± 1.00	0.13
P₆: The clarity of my voice is unpredictable	0.30 ± 0.64	0.49 ± 0.92	1.08 ± 1.00	0.04
P ₇ : I try to change my voice to sound different	0.13 ± 0.34	0.34 ± 0.80	0.50 ± 0.90	0.31
P ₈ : I use a great deal of effort to speak	0.44 ± 0.79	0.46 ± 1.01	1.00 ± 1.35	0.23
P₉: My voice is worse in the evening	0.78 ± 1.04	0.89 ± 1.16	1.83 ± 1.40	0.032
P ₁₀ : My voice ‘gives out’ on me in the middle of speaking	0.30 ± 0.64	0.29 ± 0.75	0.92 ± 1.16	0.055
Emotional Domain:				
E₁: I’m tense when talking with others because of my voice	0.22 ± 0.42	0.29 ± 0.79	1.08 ± 0.90	0.002
E ₂ : People seem irritated with my voice	0.04 ± 0.21	0.17 ± 0.62	0.33 ± 0.78	0.34
E₃: I find other people don’t understand my voice problem	0.00 ± 0.00	0.23 ± 0.84	0.83 ± 1.11	0.01
E₄: My voice problem upsets me	0.30 ± 0.56	0.46 ± 0.95	1.08 ± 0.90	0.03
E ₅ : I am less out-going because of my voice	0.04 ± 0.21	0.26 ± 0.89	0.42 ± 0.79	0.31
E₆: My voice makes me feel handicapped	0.04 ± 0.21	0.26 ± 0.78	1.08 ± 1.24	0.001
E ₇ : I feel annoyed when people ask me to repeat	0.17 ± 0.49	0.26 ± 0.78	0.50 ± 0.90	0.45
E ₈ : I feel embarrassed when people ask me to repeat	0.04 ± 0.21	0.23 ± 0.77	0.33 ± 0.78	0.39
E ₉ : My voice makes me feel incompetent	0.00 ± 0.00	0.11 ± 0.68	0.17 ± 0.58	0.62
E ₁₀ : I’m ashamed of my voice problem	0.00 ± 0.00	0.11 ± 0.68	0.17 ± 0.58	0.62

^aOne-way analysis of variance.^bMean score ± standard deviation.

morbidity may to some extent cause patients to perceive an associated dysfunction in their voice.

The recommendation from this study is that individuals with increased allergen load should be queried regarding vocal dysfunction. It has previously been shown that environmental allergens can cause laryngeal oedema and interfere with normal mucus production (2,12). This provides a possible mechanism for the development of allergy-related dysphonia. It has also been shown that patients with voice disorders have a higher-than-expected incidence of allergy (3) and patients with allergy have a higher-than-expected incidence of vocal symptoms (4). The present study expands on these earlier findings and provides further evidence that allergy and vocal symptoms are linked and that allergen load influences the severity of vocal symptoms.

Dysphonia and throat discomfort associated with chronic laryngitis is often attributed to laryngopharyngeal reflux and prompts acid suppression therapy. Indeed, two commonly used validated scores for laryngitis, the Reflux Symptom Index (RSI) (13) and the Reflux Finding Score (RFS) (14), presuppose extra-oesophageal reflux as the cause of laryngeal inflammation. The unified airway model, however, considers the respiratory passageways, from the nose to the bronchi, to be a single unit that is susceptible to environmental allergens (15) and in which the degree of atopy influences the severity of airway symptoms (16). Given that the larynx is an integral part of the airway, it is surprising that environmental allergens and irritants are not more often considered in the differential diagnosis of patients with vocal symptoms. It may explain the failure of acid

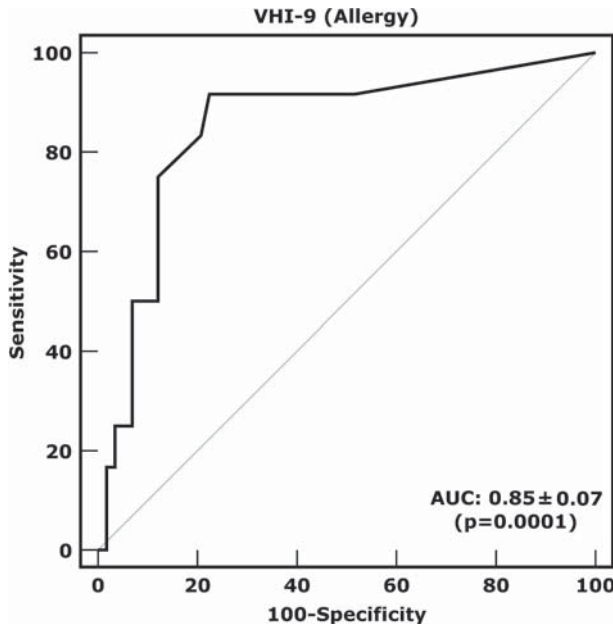


Figure 2. Receiver operating characteristic plot of the discriminant ability of the VHI-9 scale to differentiate between patients with ≥ 4 , and patients with no or fewer than 4 air-borne allergens. *P*-value is against the 0.5 AUC value which denotes lack of discriminant capacity. (AUC = area under the curve.)

suppression therapy to relieve vocal symptoms in some patients (17).

The vocal symptoms that most significantly differentiated between allergic and non-allergic patients related to vocal fatigue (P_9), unpredictability (P_2 and P_6), and creakiness (P_4). These findings are consistent with the observations of Simberg and colleagues (4) and can be explained by the presence of laryngeal oedema and abnormal mucous production (2). By combining those VHI questions that significantly differentiated between allergic and non-allergic patients we were able to devise a short questionnaire that was more specific to allergy-related voice disorders. Further research is needed to validate an allergy-specific vocal questionnaire. The present study used the number of air-borne allergens a patient reacted to, to determine the severity of allergy. Future studies would require a more quantitative approach like airway nitric oxide (18) or serum IgE (Immunoglobulin-E) measurements, as well as objective voice measurements to characterize more precisely the dose-response relationship between allergy and vocal impairment.

A potential criticism of this study is that no attempt was made to examine the larynx of the individuals and thus to correlate physical findings to VHI score. Such a procedure will be required as a further stage, and only then could focused laryngeal treatment be considered.

In conclusion, our study adds to a growing body of evidence which suggests a role for airway allergy as a cause of vocal symptoms and that patients with higher allergen exposure were more likely to have vocal symptoms than those with lower allergen exposure. The VHI can be used to screen for allergic laryngitis, and there is scope for developing and validating an allergy-specific version of the VHI. More research is needed to establish more clearly the contribution of air-borne allergies in the development of vocal symptoms and the optimal method of treating allergic laryngitis, but we recommend that it should be considered in the differential diagnosis of patients with vocal and throat symptoms.

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