

Diagnosing Allergic Rhinitis: Effectiveness of the Physical Examination in Comparison to Conventional Skin Testing

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ABSTRACT

Objective: To evaluate the effectiveness of physical examination alone in diagnosing nasal allergic patients.

Design: A cross-sectional study of 15 consecutive evaluable patients.

Setting: A tertiary care otolaryngology clinic at the Jewish General Hospital, McGill University, Montreal.

Methods: All patients were assessed by three physicians in random order. Each conducted a specific examination, made a clinical impression, and then took a directed history to make a second impression. Both impressions were compared to skin testing. Multivariate regression analyses assessed the linear relationships of both examination and history variables to impressions and skin testing results. Fleiss kappa tests assessed interrater reliabilities.

Main Outcome Measures: Accuracy in diagnosing allergic rhinitis by examination alone and inter-rater reliability in this diagnosis.

Results: When comparing physical examination variables to history variables relative to the second impression, history variables had a stronger relationship ($R^2 = .90$ vs $.52$). This was also true when comparing both sets of variables to skin testing ($R^2 = .81$ vs $.60$). The interrater reliability of physical examination variables was poorer than that of the history variables (.377 and .494, respectively). Taking all physicians, the average sensitivity, specificity, positive predictive value, and negative predictive value of the history impression were all higher than those of the examination impression.

Conclusion: Physical examination alone yields unreliable and inconsistent results in diagnosing allergic rhinitis. This is likely secondary to the relative subjectivity involved in evaluating the nasal cavity. Adding a history to the examination is essential to increase diagnostic accuracy.

SOMMAIRE

Objectif: L'étude avait pour objectif d'évaluer l'efficacité de l'examen physique seul dans le diagnostic des allergies nasales.

Type d'étude: Il s'agit d'une étude transversale, menée chez 15 patients consécutifs, se prêtant à une évaluation.

Lieu: L'étude a été menée dans un centre d'otorhinolaryngologie, de soins tertiaires, à l'Hôpital général juif, rattaché à l'Université McGill, à Montréal.

Méthodes: Tous les patients ont été évalués par trois médecins, en ordre aléatoire. Chacun a effectué un examen particulier, a donné son impression clinique, puis a procédé à une anamnèse structurée pour donner une seconde impression. Il y a ensuite eu comparaison des deux impressions avec les tests cutanés. Les relations linéaires des variables liées à l'examen et à l'anamnèse avec les impressions et les résultats des tests cutanés ont été évaluées à l'aide d'analyses multidimensionnelles de régression. Nous avons appliqué l'indice kappa de Fleiss pour mesurer la fidélité interjuges.

Principaux critères d'évaluation: Les principaux critères étaient la précision du diagnostic de rhinite allergique, posé à partir de l'examen physique seul et la fidélité interjuges au regard de ce diagnostic.

Résultats: Dans la comparaison des variables liées à l'examen physique avec celles liées à l'anamnèse relativement à la seconde impression, ces dernières avaient une relation plus forte que les premières ($R^2 = .90$ contre [c.] $.52$). Il en allait de même pour les deux ensembles de variables concernant les tests cutanés ($R^2 = .81$ c. $.60$). La fidélité interjuges relative aux variables liées à l'examen physique était plus faible que celle relative aux variables liées à l'anamnèse (.377 et .494, respectivement). Dans l'ensemble, les valeurs moyennes de la sensibilité et de la spécificité ainsi que les valeurs prévisionnelles positive et négative moyennes de l'impression découlant de l'anamnèse étaient toutes plus élevées que celles découlant de l'examen physique.

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Conclusion: L'examen physique seul donne des résultats variables, peu fiables dans le diagnostic de la rhinite allergique. Cela est probablement attribuable à la subjectivité relative, qui intervient dans l'évaluation des fosses nasales. Il est donc essentiel de joindre l'anamnèse à l'examen physique pour accroître la précision du diagnostic.

Key words: *allergic rhinitis, diagnosis, history, physical examination, skin testing*

Allergic rhinitis is a common chronic condition characterized by inflammation of the nasal mucosa. In the United States, at least 36 million people have symptoms associated with allergic rhinitis, and it is one of the most common chronic conditions in the industrialized world, with significant lifestyle impact.¹⁻⁴ Globally, it impacts 10 to 20% of the world's population.⁵ The allergens that generally produce allergic rhinitis can be either seasonal or perennial. Although the underlying pathophysiology of allergic rhinitis involves a type 1 IgE-mediated hypersensitivity reaction, a wider variety of inflammatory mediators are now known to play an active role.⁶ The late responses appear to be mediated by cytokines generated by T lymphocytes that have had fragments of the antigen presented to them.⁷

Nasal conditions are often classified as either allergic or nonallergic, and skin testing is the gold standard in making this distinction. Allergic rhinitis is frequently linked to other conditions, such as chronic rhinosinusitis and asthma.⁴ Nonallergic rhinitis encompasses a rather broad spectrum of disorders, some of which are not inflammatory (ie, structural disorders). Among others, these include infectious rhinitis, atrophic rhinitis, rhinitis medicamentosa, vasomotor rhinitis, nasal polyposis, sinusitis, and septal defects.

A number of different physical attributes can be found in patients with rhinitis; the question is whether one can use these attributes to distinguish between what is allergic and what is not. Nasal examinations often include noting the degree of septal deviation, mucosal edema, turbinate hypertrophy, turbinate colour, airway obstruction, polyps, and secretions. Given the various physical characteristics attributed to allergic rhinitis, the ability to establish an accurate diagnosis by physical examination alone is not documented in the literature. As a result, the primary objective of this study was to evaluate the effectiveness of physical examination in the diagnosis of allergic rhinitis. Secondly, the study evaluated the interrater reliability of physical examination in this setting and assessed how a focused history with an examination influences a diagnostic impression and its accuracy.

Method

Following approval from the Institutional Review Board, a cross-sectional study was conducted at the Jewish

General Hospital, Montreal, to evaluate patients with rhinitis. Fifteen consecutive evaluable patients during the 10-month study period of May 2001 to February 2002 were seen by three different physicians for examination in random order. This included an allergist, a rhinologist, and a postgraduate rhinology fellow. The inclusion criteria for this study included all adult patients with rhinitis at the Jewish General Hospital Nasal Clinic. Patients currently using systemic steroids or antihistamines and those with nasal tumours or genetic disorders were excluded from the study.

Each patient included in this study was seen by each of the three physicians in random order. A focused and directed physical examination was then performed by each physician independently. Among the components of the examination, each physician documented the degree of mucosal edema, turbinate hypertrophy, turbinate colour, airway obstruction, and quality of secretions. Each characteristic was quantified on a scale of 0 to 4. Turbinate colour and the quality of secretions were quantified on a scale of light (0) to dark (4) and thin (0) to thick (4), respectively. Finally, polyposis and septal deviations were recorded as absent or present. All examinations were carried out using a headlight and were identical for all three physicians. Following the examination, each physician made a first impression of an allergic versus a nonallergic disease process with no other knowledge apart from the patient's age, sex, and physical examination findings.

Subsequently, a focused history was taken. Each physician took a history that included information on nasal congestion, rhinitis, facial pressure, decreased smell or taste, cough, sneezing or itchiness, recurrent sinusitis, asthma, and postnasal drip. The absence or presence of these symptoms was recorded. Each physician then made a second diagnostic impression of allergic or nonallergic rhinitis based on the findings of the complete nasal history.

Skin testing for ragweed, plantain, grasses, rye, trees, birch, *Alternaria*, *Hormodendrum*, mites, dust, cats, and dogs was the gold standard and was used to provide the patients' true clinical diagnosis. The accuracy of each physician's first and second impressions was compared to the results of the skin test. The concept of doing the physical examination first was done to isolate the

examination in determining the accuracy of the first impression. The history was taken afterward not to look at it in isolation (as there is an inherent bias) but to be a means of strengthening or corroborating the diagnosis.

Statistical analysis was performed with *Minitab*, version 13.32 (Minitab Inc., State College, PA), and Microsoft *Excel* version 2002 (Microsoft Corporation, Redmond, WA), software packages.

Multivariate regression analysis was performed using physical examination variables and both first and second impressions made by each physician. This was also done for history variables and the second impression, as well as both history and examination variables with skin testing. The multivariate analysis was performed in aggregate by using the mean values of all three physicians' examination and history variables and the values of both impressions. Analysis of variance testing was then performed to evaluate the statistical significance of the linear relationship between the variables and the outcomes in question.

Given that there were more than two individual raters, the Fleiss kappa test was employed to measure the interrater reliability among the physicians for each of the physical examination and history variables, as well as both impressions. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for both impressions made by each physician with respect to skin testing results.

Results

Fifteen individuals (six males and nine females) with a mean age of 44.5 years, ranging from 19 to 69 years of age, were included in this study. Six patients had positive skin testing for atopy. When comparing results between physicians (Table 1), all three physicians changed at least one impression after having taken a history and improved in their accuracy of diagnosing the patient correctly after having done so. Relative to skin testing, the mean correct

impression following examination alone was 67%. This increased to 84% with an associated history.

Multivariate regression analysis evaluating the predictive value of physical examination and history variables, with respect to both impressions and skin testing, is outlined in Table 2. Overall, there was a strong linear relationship between physical examination variables and the first impression for all physicians—even more so when physician results were combined ($R^2 = .93$, $p = .002$). The same can be said about history variables and the final impression ($R^2 = .90$, $p = .04$). Interestingly, although not statistically significant in this study, there is a 21% increase in R^2 when a history is taken in addition to the examination relative to skin testing. It is also important to note that when analyzing history and examination variables in aggregate, no individual variable showed statistical significance on multivariate analysis with respect to skin testing.

Interrater reliability for the findings of the three physicians was also calculated using a Fleiss kappa test (Table 3). Generally speaking, values assessing interrater physical examinations were quite low, with a score of less than .5 in six of seven variables. The evaluation of polyps was the only variable showing a nearly perfect interrater reliability (.952). History values, on the other hand, generally displayed higher interrater reliabilities, with the average being .494 compared to .377 for physical examination variables.

Sensitivity, specificity, NPV, and PPV were then calculated for both impressions made by each physician with respect to skin testing. The sensitivity and specificity for the history impression were greater than or equal to those of the initial impression for all three physicians. Similar results were obtained for NPV and PPV. Taking the findings from all three physicians, the mean sensitivity

Table 1. Accuracy of Diagnosis When Comparing Examination Alone to a Combined History and Examination

Physician	Number of Impressions Changed after Taking a History	Correct Diagnosis	
		Examination Alone	Examination + History
1	5	10 (67%)	15 (100%)
2	4	8 (53%)	10 (67%)
3	1	12 (80%)	13 (87%)

Table 2. Multivariate Regression Analysis Results for Physical Examination/History Variables with the Initial Impression, Final Impression, and Skin Testing

Multivariate Analyses*	R^2	Standard Error	p Value
PE and impression 1	.93	.13	.002
History and impression 2	.90	.22	.04
PE and impression 2	.52	.41	.46
PE and skin test	.60	.44	.31
History and skin test	.81	.35	.17

*Average of all physicians.

PE = Physical Examination.

Analyses and values in bold are all statistically significant ($p < .05$).

Table 3. Interrater Reliability for Physical Examination Variables, History Variables, and Both Impressions among the Three Physicians

<i>Variables</i>	<i>κ Value</i>
Physical examination	
Septal deviation	.370
Mucosal edema	.330
Turbinate hypertrophy	.227
Turbinate colour	.480
Airway obstruction	.085
Polyps	.952
Secretion thickness	.199
Average PE variables	.377
First impression	.204
History	
Nasal congestion	.356
Runny nose	.841
Facial pressure	.520
Decreased smell/taste	.375
Cough	.705
Sneezing/itchiness	.209
Recurrent sinusitis	.257
Asthma	.792
Postnasal drip	.395
Average history variables	.494
Second impression	.544

PE = physical examination.

Fleiss kappa expresses the extent to which the observed amount of agreement among raters exceeds what would be expected if all raters made their ratings randomly.

and specificity of the examination impression were 67% and 63%, respectively. The average PPV and NPV were 50% and 80%, respectively. For the history and second impression, the mean sensitivity and specificity were both increased to 87%. The average PPV and NPV were also much higher at 77% and 93%, respectively.

Discussion

The ability to diagnose allergic rhinitis by physical examination alone would not only save time in the ability to treat a patient but would also save health care dollars because diagnostic testing and immunotherapy represent a significant economic cost for its management.⁸ Physical examinations provide important indications for diagnosis but are nonspecific. The colour and consistency of the nasal mucosa should be evaluated. Boggy, swollen membranes of the inferior turbinates as well as pale or bluish mucosa have been described to be typical of allergic rhinitis.⁹ However, although common to allergic disease,

they are not exclusive to it. Irritation or nasal decongestant abuse creates beefy red membranes; sinusitis exhibits either pale or reddish membranes.⁹ Colour variations are often subtle, making diagnosis challenging. Polyposis may exist in both allergic and nonallergic patients,¹⁰ and although allergic salute and allergic shiners are strongly suggestive of allergic disease, even these signs are not pathognomonic. The nature of the secretions may be more helpful. Yellow pus may be bacterial infection. Bloody or crusty secretions and ulcerations suggest bacterial infections, a neoplastic process, or granulomatous disease. Clear secretions imply either allergy or viral infection.

Gendo and colleagues showed that taking a history of nasal symptoms in the absence of a cold or flu has a positive likelihood ratio of 1.38 and a negative likelihood ratio of 0.65 for predicting allergic rhinitis.¹¹ Presenting symptoms often associated with allergic rhinitis include nasal obstruction, congestion, rhinorrhea (both anterior and posterior), paranasal pain or headache, sneezing, pruritus, itchy or watery eyes, anosmia or dysosmia, chronic pharyngitis, hoarseness, and recurrent infections of the nose or sinuses. History taking requires awareness not only about nasal disorders per se but also about systemic disorders with nasal manifestations. Inhalant allergy of the upper respiratory tract may lead to and affect other disease states, such as nasal polyposis, sinusitis, otitis media, and asthma.¹² Most of these comorbidities can be accounted for based on the anatomic relationships between the nasal cavities and the affected organs. However, the likelihood that allergic rhinitis has a systemic aspect potentially leading to these comorbidities has also been considered.¹³ Furthermore, a good social and family history can also provide important information leading to a diagnosis.¹⁴

These well-known descriptions guided the history and examination variables used in this study. When analyzing the data, the strong relationship elicited by the physical examination variables and the first impression, as well as that of the history and the second impression, can be expected. This is because the two are directly related, and these impressions were ultimately dependent on the variables used to derive them.

However, when looking at the data collectively, the relationship between history variables and the final impression was greater than that of the examination variables with the final impression ($R^2 = .9$ and $.52$, respectively). This indicates that, generally speaking, the same impression for determining a patient's diagnosis for allergic rhinitis could not be elicited as consistently with physical examination alone compared to a history combined with a focused examination. Overall, physical

examination variables alone are consistently poor predictors in diagnosing allergic rhinitis. This is confirmed with each physician's individual assessment as well as when the data are examined collectively. This is apparent when comparing skin testing with examination alone to that of a combined history and physical examination ($R^2 = .6$ and $.81$, respectively). Given our small sample size, neither of these results has statistical significance, and it is difficult to draw definite conclusions. A larger study in the future would be required to achieve this. Nevertheless, there is certainly a suggestion that physical examination alone is not as accurate.

This is consistent with the literature as it has been repeatedly demonstrated that patient history contributes significantly to making a correct diagnosis.^{15–19} Although no studies have been conducted to evaluate this for allergic rhinitis, our results exemplify this fact, which is well known in the general medical literature.

One of the factors that could explain the positive correlation between a combined history and examination with the diagnosis as opposed to that of a physical examination alone is the subjectivity of the physical examinations themselves. A physician's specialty training, patient population, and overall experience can factor into the interpretation of physical examinations. This study demonstrates a poorer interrater reliability when comparing average physical examination variables to average history variables ($\kappa = .377$ vs $.494$, respectively). Degree of airway obstruction, secretion thickness, turbinate hypertrophy, and mucosal edema all had interrater reliabilities less than $.330$. This is in contrast to visualizing polyps, which had a high reliability of $.952$. This was expected as polyps are often relatively easy to identify. On the other hand, the other aforementioned variables are much more subjective in nature. Ultimately, having poor interrater reliability for physical examination would contribute to generating an inaccurate diagnosis if used alone. That being said, there were also a number of history variables with a low interrater reliability. This was likely attributed to vague patient description and corresponding physician interpretation and inconsistencies by the patients themselves or may be secondary to the variance associated with how a physician phrases a question, leading to varied responses. Nevertheless, history variables show a greater overall interrater reliability than physical examination variables.

To further illustrate how physical examination alone is a poor diagnostic tool in detecting allergic rhinitis in patients, this study showed consistently higher specificity and PPV when a history was incorporated in the

assessment. This was also true for sensitivity and NPV in all but two cases, where there was no change. When looking at aggregate values from all three physicians, all of these parameters increased in value.

Conclusion

Relative to skin testing, it is difficult to yield reliable and consistent results in diagnosing allergic rhinitis when relying on physical examination alone. This is likely due to the subjective elements related to the nasal physical examination, particularly in the absence of a history to guide one's examination. As with much of medicine, a history in addition to the examination is essential in developing an accurate diagnosis. This is well described in the literature and alludes to the importance of obtaining a detailed clinical history when assessing patients.

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