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Comparison of allergic rhinitis and vasomotor rhinitis patients on the basis of a computer questionnaire

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From 1 July 1990 to 31 December 1991, all patients referred to the Allergy Section of the ENT Department, University Hospital, Lund, Sweden, ($n = 678$) answered a 134-item questionnaire presented on the screen of a personal computer by pressing **Y** (for yes) or **N** (for no) on the keyboard. The objective of this study was to compare the questionnaire responses from patients with allergic rhinitis (AR) with those of patients with perennial nonallergic rhinitis or vasomotor rhinitis (VMR). Nasal blockage was the predominant symptom in the VMR group, whereas the AR patients mainly suffered from eye irritation, sneezing, and, to some extent, rhinorrhea. Concomitant asthma was more prevalent in the AR group than in the VMR group, whose histories were characterized by symptoms associated with airway infections. About 60% of both groups reported problems with such nonspecific airway irritants as cigarette smoke and perfumes. With respect to the diagnostic reliability of the history, in the AR group the order of accuracy (according to the skin prick test results) of reported hypersensitivity to allergens was as follows: cat > timothy > birch > dust mite > mugwort. A history of hypersensitivity to molds as a cause of symptoms was of no diagnostic value. The findings suggest that there are several differences in the medical histories of AR and VMR patients that merit further investigation.

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The first step in allergologic work-up is always the taking of a careful history. Thus, despite the availability of a number of objective tests, such as the skin prick or RAST (radioallergosorbent test), for investigating the cause of allergies and allergy-like reactions, the patient's own conception of the symptoms and their genesis is of the utmost importance to diagnosis and choice of treatment.

To facilitate the questioning of patients, many departments dealing with cases of hypersensitivity symptoms prepare very comprehensive questionnaires; and although some departments do have the resources for transferring the patient's answers to database systems, it is a time-consuming and costly procedure.

As computer-based questionnaires have been reported to be a useful means of obtaining a detailed history from asthma patients (1, 5), we developed a computer-based questionnaire for patients with suspected allergic rhinitis (AR). Since this questionnaire was adopted for routine clinical use in our department at the beginning of 1989, it has become evident that many rhinologic patients suffer from vasomotor rhinitis (VMR), also known as perennial nonallergic rhinitis, rather than allergic rhinitis (AR). In contrast to AR, where in most cases the diagnosis is fairly straightforward and the treatment well established, the diagnosis of VMR, owing to the lack of objective tests, is usually a process of elimination. The main objective of the present investigation was therefore to compare the questionnaire responses of AR patients with those of VMR patients. In addition, the relevance of the AR patients' conceptions of their hypersensitivity to common allergens was studied.

Material and methods

The patients studied comprised cases referred to the Allergy Section of the ENT Department, University Hospital, Lund, Sweden, during the period 1 July 1990 to 31 December 1991 ($n = 678$). The patients

answered the questionnaire at their first visit to the Allergy Section.

A personal computer (IBM PS/2, model 50) was used. The necessary program was written in QuickBasic (Microsoft Corporation, WA, USA) by one of the team (S.L.), and comprised 134 questions that could be answered by typing **Y** (yes) or **N** (no) on the keyboard. Six questions required the patient to rate the severity of the various symptoms on 6-point scales. A staff member (a secretary or nurse) gave the necessary instruction to the patient, and entered the patient's name, date of birth, height, weight, and profession. For confidentiality, the social security number and any other data that might identify a particular patient to an outsider were omitted. Further instructions, in the form of four simple sentences, were then displayed on the screen, at which point patients were usually left to complete the questionnaire on their own, the questions being presented in succession as each one was answered. The 134 questions were arranged in groups, a main item being followed by a number of related questions, to elicit greater accuracy by providing patients with an opportunity of checking their answers and amending them if incorrect. When a main question was answered with no, the related questions were omitted. Thus, virtually no patient had to answer all 134 questions.

Immediately after the final question was answered, all questions answered affirmatively were automatically printed out in the form of statements, the printout being given to the attending physician. For instance, if answered affirmatively, the question "Do you believe that grass pollen causes your symptoms?" would be printed out as "The patient believes grass pollen to cause the symptoms." The data from each questionnaire were added to a database (PC-File +, Buttonware, CA, USA).

The results of skin prick tests were later added to a related database by a member of the staff.

The questionnaire was divided into two main parts, the first concerning the patient's symptoms and the second concerning the patient's opinion of what caused or aggravated the symptoms.

Upon completing the questionnaire, the patient was examined by the consulting physician, who then ordered appropriate skin prick tests and RAST examinations. The minimum investigation performed in all patients was a standard panel of skin prick tests for the following allergens: timothy, birch, mugwort, *Dermatophagoides pteronyssinus*, *D. farinae*, *Alternaria*, *Cladosporium*, cat, dog, and horse (Soluprick 10 HEP, ALK, Copenhagen, Denmark). The resulting wheals (if any) were compared to the histamine standard (10 mg/ml). The wheals were measured as the product of the largest diameter and the corresponding orthogonal diameter (both in mm). The diameters were fed into the database, and a ratio was calculated as the quotient of the area of a wheal produced by an allergen divided by the area of the wheal produced by histamine. If the ratio was 1 or more, the diagnosis of allergy against that particular allergen was considered to be positive, a ratio larger than zero but less than 1 was considered to be cause to suspect allergy, and a ratio of zero was considered to be negative. On the results of the examination and the skin prick tests, the patients were assigned by the attending physician to one of the following three groups: AR, VMR, or other diagnoses (mainly severe deviation of the nasal septum, nasal polyposis, and infection).

Statistics

The χ^2 test was used for comparisons between the AR and VMR groups. Multiple comparisons were made according to the Newman-Keul test. P values of <0.05 were considered to be significant, except for the multiple comparisons where a significance level of 0.01 was chosen.

Results

The time spent at the computer by the patients averaged 13 min (13.1 ± 4.6 min, mean and SD; low quartile 10.1 min and high quartile 15.2 min). About 5% of patients needed help from a nurse or secretary throughout, 25% needed help for a few minutes one to three times, and 70% completed the questionnaire unaided.

The patients were classified as AR in 258 cases (38.1%), VMR in 317 cases (46.8%), and other diagnoses in 103 cases (15.2%). The age distribution of the patients is shown in Fig. 1. There was no correlation between either age or sex and the time taken to answer the questionnaire. The age distribution differed in the various groups, the median age being 26 years in the AR group, 32 in the VMR, and 44 in the group of other diagnoses (Newman-Keul test). In the following, all comparisons referred to are those between the AR and VMR groups.

There was no difference between the AR and VMR groups regarding the male:female ratio or the proportion of smokers. The frequency of smokers was 17.4% among AR patients, as compared with 23.3% among VMR patients.

The major nasal complaints which brought the patients to the Allergy Section are shown in Fig. 2, nasal blockage predominating in the VMR group, whereas sneezing and eye irritation, and, to a lesser extent, rhinorrhea predominated in the AR group.

Attacks of nasal blockage and secretion were more common in the AR group (53.9% and 40.4%, 58.9%

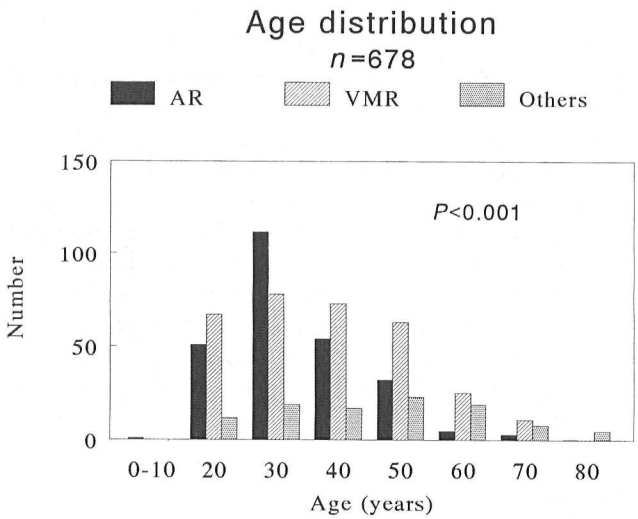

Fig. 1. Age distributions of 678 consecutive outpatients with symptoms of nasal hypersensitivity who at their first visit to the allergy section answered a computer-based questionnaire. Patients are divided into three groups; AR (allergic rhinitis), VMR (vasomotor rhinitis), and other diagnoses (e.g., deviated nasal septum or infections).

and 35.6%, respectively). There was no difference between the two groups in frequency of reported aggravation of symptoms by airway irritants such as cigarette smoke or strong perfume (55.1% in the AR; 60.9% in the VMR group).

Histories of urticaria, atopic eczema, and pseudocroup were similarly prevalent in both groups, whereas a history of asthma was more frequent in the AR group, and a history of sinusitis more frequent in the VMR group. The VMR patients also reported that infections either triggered or aggravated their symptoms (Table 1).

Reported hypersensitivity to common airway allergens was more frequent in the AR group than in the VMR group (Fig. 3). In both groups, dust mites and molds were frequently reported causes of symptoms.

The relevance of the history (according to skin prick test results) was investigated in the AR group. As determined by the χ^2 test, the order of accuracy of reported hypersensitivity to allergens was as follows: cat > timothy > birch > dust mite > mugwort (Table 2). History of sensitivity to molds was of no diagnostic value.

Discussion

That all 678 patients were required to answer a questionnaire directly on the keyboard of a computer entailed surprisingly little extra work for the staff at the Allergy Section. One disadvantage, however, is that confrontation with a computer screen exerts pressure on the patients to answer as fast as possible, in turn leading to incorrect responses. In contrast, a printed questionnaire sent to their home address is much more leisurely answered. On the other hand, at the clinic patients are able to check with the staff the intended meaning of any question of which they are in doubt. There was no correlation between age and the time taken to answer the questionnaire, suggesting that elderly patients also readily adapt to this new means of taking the medical history. In fact, our experience is consistent with the report by Tanser & Davies that computer interrogation was even enjoyed by the patients (5).

A major advantage of a computer-based questionnaire is that all answers are uniform (i.e., either yes or no), thus facilitating comparison between patients or groups of patients. Being stored in a database, the data are readily available for use in epidemiologic evaluations and the selection of patients for research. Another advantage is that the records require less space in the archives. The typewritten questionnaires previously used at our department required six sheets of A4 paper, whereas the present (affirmative) answers usually take only one or at the most two sheets.

There were several differences between AR and VMR patients in the present investigation that may have important clinical implications. In the VMR group the predominant symptom was nasal blockage, whereas rhinorrhea and, in particular, sneezing and eye irritation were relatively uncommon among these patients. The two latter symptoms, which were frequent in the AR patients, indicate the involvement of nervous mechanisms, sneezing being considered a typical airway defense reflex (2), while eye irritation indicates the activation of sensory nerve endings in the conjunctivae. The hypothesized involvement of nervous mechanisms in the symptoms of AR, but

Table 1. Other diseases in the medical histories of patients with allergic rhinitis (AR) or vasomotor rhinitis (VMR)

	AR	VMR	χ^2
Eczema	45(17.4%)	45(20.2%)	0.90 NS
Urticaria	66(25.6%)	64(20.2%)	2.07 NS
Pseudocroup	20(7.8%)	13(4.1%)	2.86 NS
Asthma	40(15.5%)	25(7.9%)	7.49 **
Sinusitis	90(34.9%)	171(53.9%)	20.08 ***
Triggered by infection	44(17.1%)	79(24.9%)	4.78 *
Aggravated by infection	91(35.3%)	159(50.2%)	12.23 ***

Numbers represent affirmative questionnaire answers in each group, and figures in parentheses the corresponding percentages. * = $P<0.05$; ** = $P<0.01$; *** = $P<0.001$.

not VMR, patients derives further support from the fact that symptomatic attacks were more frequent in the AR patients than in the VMR patients. Interestingly, although nasal blockage was a symptom typical of the VMR group, reported attack blockage was still more frequent in the AR group. These results appear to provide no support for the recent suggestion that activity in some sensory neurons (tentatively capsaicin-sensitive unmyelinated C-fibers) causes the development of VMR (3). However, in the present series, no subdivision of the VMR patients was performed, and it is possible that a subgroup of VMR patients with sneezing and rhinorrhea as their major symptoms may suffer from hyperactivity in sensory C-fibers of this kind. Indeed, Stjärne et al. found no difference in response to challenge with capsaicin or nicotine between an unselected group of VMR patients and asymptomatic controls (4). Only when VMR patients with rhinorrhea as their major symptom were selected was a significant increase in nasal secretion in response to challenge detected. The present results emphasize the need for objective provocation tests in the diagnosis of VMR.

The finding that concomitant asthma was more frequent in the AR group than in the VMR group is not surprising. As the present series predominantly consisted of young patients, occurrence of exogenous asthma and AR could be expected to be relatively common. Endogenous asthma occurs predominantly among the middle-aged and elderly, a category of patients who, with the exception of nasal polyposis, do not manifest nasal complaints to the same extent. Accordingly, few cases of endogenous asthma are referred to our department.

Sinusitis was more frequent in the VMR group. Although the reported frequency of about 55% probably represents an overestimation of the true incidence of sinusitis (since it was not based on anthral irrigation, radiography, CT scanning or sinus ultrasonography), the finding suggests that infectious upper airway disease may be involved in the pathogenesis of VMR. Moreover, reports that prodromal symptoms were triggered by infection or aggravated by airway infection were more frequent among VMR than AR patients. Taken together, these findings suggest that the VMR category may include a subgroup of patients who have either postinfectious symptoms after an upper airway disease (probably of viral origin), or a long-lasting subclinical infection in the nose, sinuses, or nasopharynx. We have therefore modified our routine work-up for this category of patients, and now include not only a nasopharyngeal swab for bacterial growth, but frequently naso- and sinoscopy as well.

That the history is of utmost importance in the diagnosis of nasal hyperreactivity, especially with

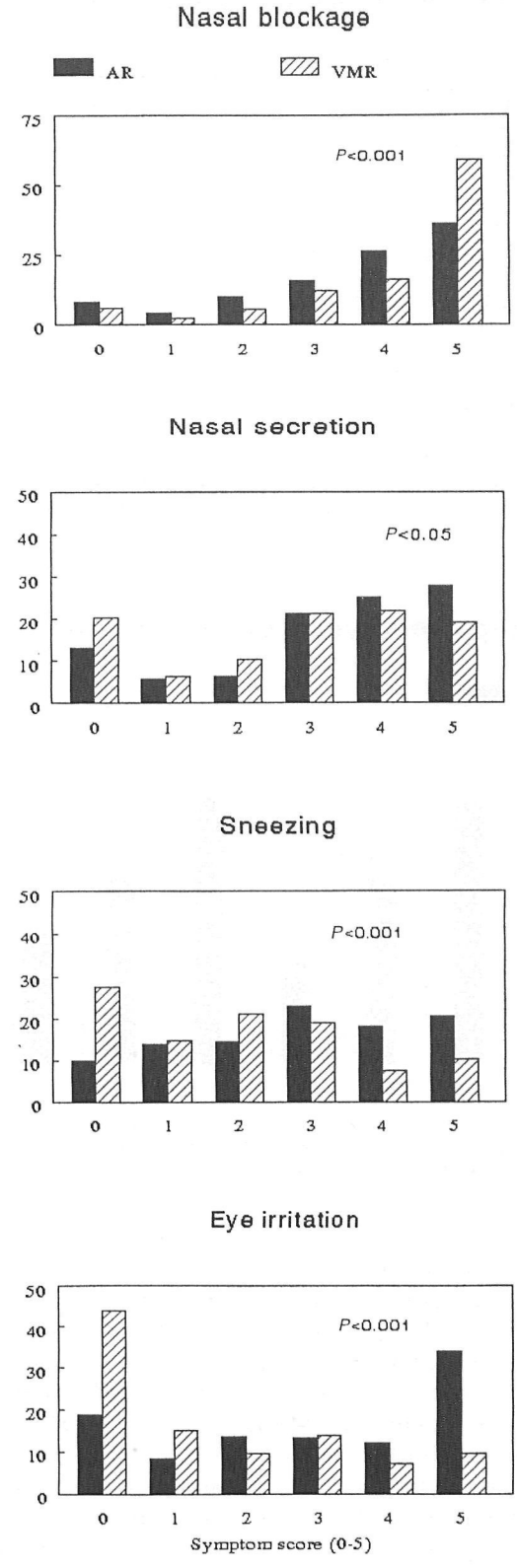

Fig. 2. Nasal blockage, nasal secretion, sneezing, and eye irritation among patients with allergic rhinitis (AR) (solid bars) ($n = 258$) and vasomotor rhinitis (VMR) (hatched bars) ($n = 317$). Patients rated their symptoms on 6-point scale where 0 = no symptoms and 5 = worst possible symptoms.

Table 2. Reported history (i.e., questionnaire response) and skin prick test results in patients with allergic rhinitis (AR) (n=258)

	Yes			No			
Allergen	Negative	Positive?	Positive	Negative	Positive?	Positive	χ^2
Cat	18	29	46	117	31	17	71.49 ***
Timothy	28	26	76	78	29	21	54.92 ***
Birch	24	11	58	105	23	37	42.99 ***
D. pteronyssinus	77	29	28	100	20	4	22.29 ***
Mugwort	30	17	3	177	23	8	17.29 ***
Mold (*Alternaria*)	55	6	4	179	9	5	3.87 NS

Yes-responders are compared with *No*-responders. *Negative* denotes no wheal at skin prick testing, *Positive?* a wheal smaller than the corresponding response to the histamine standard, and *Positive* a wheal of the same size or larger than the histamine standard. Number of patients in each group is given for each allergen. *=$P<0.05$; **=$P<0.01$; ***=$P<0.001$.

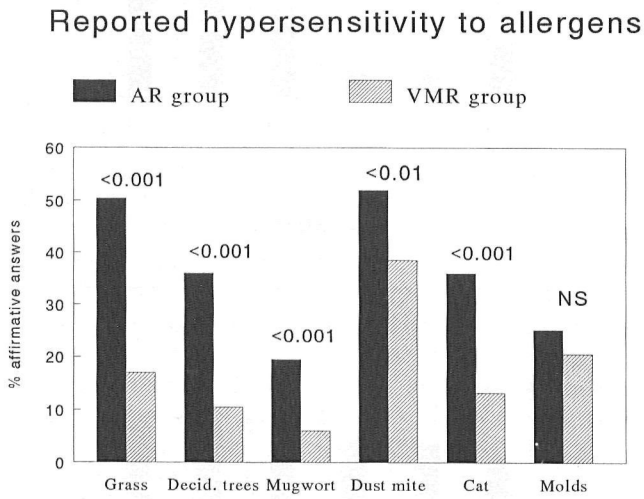

Fig. 3. Hypersensitivity to common airway allergens, as reported by patients with allergic rhinitis (AR) (solid bars) or vasomotor rhinitis (VMR) (hatched bars).

regard to the cause of symptoms, was clearly illustrated in the present series. Thus, reports that common airway allergens such as those of cat fur or pollen of grass and deciduous trees caused their symptoms were more frequent in the AR group than in the (nonallergic) VMR group (Fig. 3). However, although the frequency of reports of dust mite as a cause of symptoms was significantly higher in the AR group, it was nonetheless quite high in the VMR group (approximately 40%), which is probably to be explained by the nonspecific irritant effect of dust particles on the nasal mucosa. In both groups, about 25% of the patients reported molds to be a cause of symptoms, although this high anamnestic frequency was not confirmed by the results of the skin prick tests even in the AR group. One explanation of the overestimation of molds as a cause of symptoms may be the fact that in Sweden molds are commonly regarded by the general public to be a cause of airway problems, owing to several reports of the "sick house syndrome" in the mass media during recent years. It might be argued that *Alternaria* and *Cladosporium* do not account for all cases of hypersensitivity to molds, and that since the end of 1991 we have added *Aspergillus*, *Penicillium*, and *Mucor* to our standard panel of skin prick tests. However, the frequency of positive skin prick test results for molds has increased little despite the use of the extended panel (Lindberg, unpublished results).

With the exception of molds, the accuracy of the medical history as a diagnostic tool was confirmed in the AR patients (Table 2). The cat was the easiest cause of symptoms to detect, illustrating that contact with the animal may function as a provocation test. It was almost as easy for patients to detect pollens of grass and deciduous trees as causes of symptoms. The less clear relationship between questionnaire answers and skin prick test results regarding hypersensitivity to dust mite and mugwort may have been due to the nonspecific irritant effect of dust on the mucosa (also the VMR patients reported a high frequency of dust problems), and unfamiliarity with mugwort among the general public, both botanically and as a cause of allergy.

To sum up, the present findings suggest that a computer-based questionnaire regarding hypersensitivity symptoms is easily understood and satisfactorily completed by patients, and that it is of clinical and administrative value for the easy storage and retrieval of data. The questionnaire answers revealed several interesting differences in the medical histories of the AR and VMR patients that merit clinical consideration and further investigation.

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