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Evaluation of a diagnostic questionnaire for nasal polyposis: an observational, cross-sectional study*

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SUMMARY

Nasal polyposis (NP) represents actually a matter of concern for most ear, nose and throat (ENT) specialists. In France, we lack data on NP prevalence due to the unavailability of a validated diagnostic questionnaire easily usable in population-based studies.

The present study tested the sensitivity and specificity of an 11-item questionnaire for NP diagnosis from which an algorithm of diagnosis decision was inferred. Outpatients from 3 ENT departments were asked to complete the questionnaire prior to their visit. After the visit, the investigator had to write his final diagnosis (FD) on the envelope containing the questionnaire, without reading the patient's responses.

Data from 406 patients showed a good specificity and sensitivity of most items. Awareness of NP, previous cortisone therapy for nasal pathology, and history of nasal surgery were shown to be the most discriminating items. An algorithm was elaborated by aggregation of the different items; its specificity and sensitivity were close to 90%.

These diagnostic questionnaire and algorithm, although not substitutable to a clinical diagnosis, should be very useful for population-based studies.

Key words: nasal polyposis, diagnosis, questionnaire, specificity and sensitivity, algorithm

INTRODUCTION

Any nasal inflammatory condition, such as chronic or acute, allergic or non-allergic rhinitis or rhino-sinusitis significantly impacts the patient's quality of life by causing fatigue, loss of productivity, headache, cognitive impairment, and other systemic symptoms. The frequency of inflammatory respiratory diseases, rhinitis in particular, constantly increases in most industrialized countries, inducing widespread morbidity and treatment costs (Dykewicz et al., 1998a). Nasal polyposis (NP) is a chronic oedematous pansinusitis that may mimic symptoms of rhinitis. It originates from the ethmoid cells, and may cause obturation of the maxillary, frontal, and sphenoid sinuses, with mucus retention or even polyps inside these cavities.

NP may occur in conjunction with other forms of chronic rhinitis or sinusitis, and even with allergic rhinitis; it has been shown that 10-15% of patients with allergic rhinitis also have NP (Fireman, 1996). Nevertheless, allergy as a cause of this disease remains debated (Keith et al., 1997; Slavin, 1997). Besides, some respiratory pathologies such as asthma, aspirin intolerance, and cystic fibrosis are often observed to be associated with NP (Settipane, 1996; Jankowski, 1997). In addition to symptoms of rhinitis, olfactory impairment frequently occurs. Early detection of polyps, by a differential diagnosis of patients who present with invariant nasal congestion, should help avoiding advanced stages of the pathology or misdiagnosis (Dykewicz et al., 1998a, b).

The exact prevalence of NP in the general population remains not known firstly due to an insufficient number of epidemiological studies, and then because the results of these rare studies depend on the selection of the study population and the diagnostic methods used (Van der Baan, 1997); moreover, natural history of NP can be influenced by a series of parameters such as age, allergy, infections and eosinophil inflammation (Van der Baan, 1997).

In France, the lack of epidemiological data on this disease is essentially due to the unavailability of a simple and reliable tool for NP detection that could be used in population-based

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studies. A diagnostic questionnaire with a well-established good sensitivity and specificity should be helpful, such as those existing for other respiratory pathologies – asthma, chronic bronchitis, allergic rhinitis – (MRC, 1966; Burney et al., 1987; Minette, 1989; European Community Respiratory Health Survey, 1994; Annesi-Maesano et al., 2002; Kauffmann et al., 2002) and which have been used for prevalence assessments.

A diagnostic questionnaire elaborated by a French expert panel of ENT specialists was proposed to patients visiting hospital ENT departments. Its sensitivity and specificity were assessed and are reported in the present paper together with a diagnostic algorithm derived from this questionnaire.

MATERIALS AND METHODS

This observational cross-sectional multicentric study lasted 4 weeks and was carried out in three ENT hospital departments located in different regions of France. The objectives were to evaluate the specificity and sensitivity of a questionnaire for NP diagnosis (Figure 1), and to test an algorithm of disease detection inferred from this questionnaire after identification and combination of the most discriminating items.

The questionnaire was elaborated by a French expert panel of ENT specialists. The set of questions was based on their clinical experience rather than on an existing questionnaire to be translated from another language or adapted from another pathological context. The methodology by which the original questions were selected was the following:

1. Have you a good perception of odours? Yes [ ] No [ ]
   If you answered *no* → For how long? [ ][ ] year(s) [ ][ ] month(s)
   Please specify → Continuously [ ] Intermittently [ ]
   Is there any medication that improves your odour perception? Yes [ ] No [ ]

2. Is your nose frequently blocked? Yes [ ] No [ ]
   If you answered *yes* → For how long? [ ][ ] year(s) [ ][ ] month(s)
   Please specify → One side [ ] Both sides [ ]
   → Continuously [ ] Intermittently [ ]

3. Do you have colds frequently? Yes [ ] No [ ]
   If you answered *yes* → Colds occur Only during winter [ ]
   Whatever the season [ ]

4. Do you have asthma? Yes [ ] No [ ]
   If you answered *yes* → Is it triggered or aggravated by aspirin intake? Yes [ ] No [ ]

5. Have you noted any event following aspirin intake? Yes [ ] No [ ]

6. Have you ever taken cortisone for your nose? Yes [ ] No [ ]
   If you answered *yes* → By which route? Local treatment [ ]
   General/ oral route [ ]

7. Are you currently taking a medication for your nose? Yes [ ] No [ ]
   If you answered *yes* → Please specify which .....
   → Regularly [ ] From time to time [ ]

8. Have you ever undergone surgery in the sinus cavities? Yes [ ] No [ ]
   If you answered *yes* → For which of the following
   reasons? Plastic surgery [ ]
   Sinusitis [ ]
   Polyposis [ ]

9. Have you ever had your nose broken? Yes [ ] No [ ]

10. Do you have polyps in your nose? Yes [ ] No [ ]

11. Do any member of your family have polyps in the nose? Yes [ ] No [ ]

Figure 1. The questionnaire, translated in English.

1. The first phase consisted in a literature research on NP clinical symptomatology (signs and/or symptoms) in order to identify the symptoms likely to be the most relevant for the NP diagnosis.
2. The second phase consisted in the construction and writing of a first draft of the screening questionnaire on the basis of the signs and symptoms identified in the literature.
3. This draft was then sent separately to the ENT experts for advice, correction (suppression or addition of questions), and/or re-formulation in order to be closer to patients' wording.

The self-administered diagnostic questionnaire consisted of 11 principal questions, of which some were followed by a set of sub-questions for a more detailed description. The questions were written using patients' wording in order to ensure maximal comprehension and optimise the rate of response. Figure 1 presents the English translation of the questionnaire originally written in the French language. After the questionnaire was completed by the patient (prior to the ENT visit), and after clinical examination and nasal endoscopy were performed, the investigator had to write his final diagnosis (FD) on the envelope containing the questionnaire, without reading the patient's answers. The FD was to be expressed as presence or absence of NP.

Any patient aged 18 years or more and referred to one of the three investigator centres could be included in the study; there were no criteria of non-inclusion.

Statistical analysis

Data management and statistical analyses of the responses to the questionnaire were performed using SAS software, version 6.12 (SAS Institute, North Carolina, USA). The elaboration of the diagnostic algorithm was performed using the Alice d'Isoft Data Mining software for decision trees (www.isoft.fr).

Statistics were carried out using 2-tailed tests, with a statistical significance level set at 5%. The analysis of the answers to the questionnaire was performed by simple tabulation and then by cross-tabulation with the FD. Descriptive statistics are provided, qualitative variables presented as percentages, and quantitative data as mean standard deviation (SD). Data were analysed in the total population and by subgroups of patients distributed according to the FD (NP patients vs. patients without NP). The relationship between each variable and the FD was determined using a Chi-square test; Student's test was used for quantitative responses, and Wilcoxon's in case of non-normality of the variable.

Each question was tested in terms of sensitivity and specificity regarding the FD. The method used for the calculation was

Table 1. Characteristics of the study population in terms of nasal pathology: distribution of the patients by NP diagnosis and questionnaire items (data presented as % except for durations, expressed as months ± SD).

	Patients without NP	Patients with NP	All	P*
1. Poor perception of odours	16.7	65.0	24.2	<0.001
Duration of smell disorders	73.3 ± 12.0	82.9 ± 73.5		0.02
Continuous anosmia	45.5	51.6	48.0	Ns
Existence of a medication for anosmia	11.5	50.0	32.8	0.02
2. Frequent occurrence of blocked nose	37.7	60.8	41.2	0.002
Duration of frequent blocked nose	104.8 ± 137.6	117.6 ± 142.1		Ns
Bilateral blocking	62.2	80.8	66.4	Ns
Continuous blocking	25.8	30.8	27.0	Ns
3. Frequent occurrence of colds	38.1	54.4	40.6	0.02
Only in winter / whichever the season	25.4 / 74.6	9.7 / 90.3	22.1 / 77.9	Ns
4. Prevalence of asthma	7.0	39.3	12.0	<0.001
Aspirin = trigger or aggravating factor	10.0	31.6	20.5	Ns
5. Events following aspirin intake	10.8	35.8	14.4	<0.001
6. Experience of cortisone intake	24.3	88.0	33.5	<0.001
Local application	68.8	40.5	57.5	0.02
7. Actual treatment	22.0	78.8	29.9	<0.001
Regular / occasional intakes	43.5 / 56.5	78.9 / 21.1	57.0 / 43.0	<0.001
8. History of sinonasal surgery	22.1	72.9	29.7	<0.001
Reason: plastic / sinusitis / polyposis	12.7 / 63.6 / 32.7	0.0 / 35.7 / 78.6	7.2 / 51.5 / 52.6	Na
9. History of broken nose	13.6	6.6	12.5	Ns
10. Awareness of actual NP	7.7	83.9	19.2	<0.001
11. Familial history of NP	5.1	14.3	6.5	0.01

*NP: nasal polyposis. * P value for the relationship with the final diagnosis*

based only on the effective number of responses for each question, the denominator for the specificity and sensitivity being the sum of effective responses (i.e., the number of patients in the group – the number of missing responses).

The discriminatory analysis of the FD regarding the responses, performed using the Data Mining software, was based on the segmentation of the study population according to a tree diagram elaborated using the most discriminating variables for the constitution of subgroups. The calculation of the information gain was based on the Mantaras distance (Mantaras, 1991). The threshold for statistical significance was at least 95%, evaluated either using a Chi-square test, or Fisher's test, depending on the variable to analyse.

The decision trees obtained using this method were presented to the ENT experts; following analysis, one algorithm for disease detection was selected; this algorithm is presented in the present paper.

RESULTS

Study patients

The questionnaire was completed by 414 patients visiting the ENT departments of Poitiers, Toulouse, and Nancy hospitals, located in central, southern, and northern France, respectively. Of them, 8 did not have the FD written on their envelope. A total of 406 patients constituted therefore the study population. NP was diagnosed by the ENT doctors in 15.5% of these patients.

Description of the study population according to the answers

Table 1 displays the characteristics of the study population distributed according to the FD (presence/absence of NP), in terms of olfactory and respiratory status.

Overall, a quarter of the population reported poor odour perception; among this subset of anosmic patients, most (65.0%) had NP and a large part (67.2%) had never utilized a treatment for this disorder despite the fact that about half of them experienced continuous anosmia.

Table 2. Rates (%) of missing responses for each of the principal questionnaire items (complementary sub-questions are not taken into account), with the population distributed according to the final diagnosis.

Principal items of the questionnaire	**Patients without NP**	**Patients with NP**	**P***
1. Have you a good perception of odours?	4.1	4.8	0.80
2. Is your nose frequently blocked?	17.2	19.0	0.72
3. Do you have colds frequently?	6.7	9.5	0.42
4. Do you have asthma?	3.8	3.2	0.81
5. Have you noted any event following aspirin intake ?	8.5	15.9	0.07
6. Have you ever taken cortisone for your nose?	13.7	20.6	0.15
7. Are you currently taking a medication for your nose?	6.1	17.5	<0.01
8. Have you ever undergone surgery in the sinus cavities?	3.5	6.3	0.29
9. Have you ever had your nose broken?	3.2	3.2	0.99
10. Do you have polyps in your nose?	8.7	11.1	0.55
11. Do any member of your family have polyps in the nose?	8.7	11.1	0.55

*NP: nasal polyposis. * P value for the relationship with the final diagnosis*

Table 3. Sensitivity and specificity of each of the principal questionnaire items (sub-questions not taken into account) with the population distributed according to the final diagnosis, and taking into account the number of missing data (data presented as %).

		Sensitivity	**Specificity**	**P***
		Based on the total number of responses from:		
Principal items of the questionnaire		**Patients with NP**	**Patients without NP**	
1. Have you a good perception of odours?	No	65.0	83.3	***
2. Is your nose frequently blocked?	Yes	60.8	62.3	**
3. Do you have colds frequently?	Yes	54.4	61.9	*
4. Do you have asthma?	Yes	39.3	93.0	***
5. Have you noted any event following aspirin intake?	Yes	35.8	89.2	***
6. Have you ever taken cortisone for your nose?	Yes	88.0	75.7	***
7. Are you currently taking a medication for your nose?	Yes	78.8	78.0	***
8. Have you ever undergone surgery in the sinus cavities?	Yes	72.9	77.9	***
9. Have you ever had your nose broken?	Yes	6.6	86.4	NS
10. Do you have polyps in your nose?	Yes	83.9	92.3	***
11. Do any member of your family have polyps in the nose?	Yes	14.3	94.9	*

** P<0.05; ** P<0.01; ***P<0.001; NS=not significant*

Blocked nose was more frequently reported by NP patients, occurring bilaterally in 66.4%, and permanently in 27% of NP sufferers. Frequent colds, reported by 40.6% of the patients, appeared unrelated to the season.

Asthma was present in 12.0% of the population; it was significantly more frequent in the subgroup of patients with NP compared to patients free of NP.

Aspirin as a trigger or aggravating factor was reported more often by NP patients than by those without NP, but the difference did not reach statistical significance ($p=0.06$). Aspirin-related events were reported significantly ($p<0.001$) more frequently by NP patients compared to NP-free patients.

Previous treatment by corticoid drugs was reported significantly more frequently by NP patients ($p<0.001$). At the time of the survey, about a third of the patients was treated for a nasal pathology; most treated patients reported regularity of treatment intakes.

Among patients with previous experience of sinonasal surgery, sinusitis and NP were the main reasons for surgery, plastic surgery accounting for less than 10%. History of broken nose did not differ between patients with and without NP. A familial history of NP was reported by 14.3% of patients with NP.

Nineteen percent of the patients declared themselves as having NP; this coincided with the FD in 83.9% of them.

Analysis of the rate of missing data

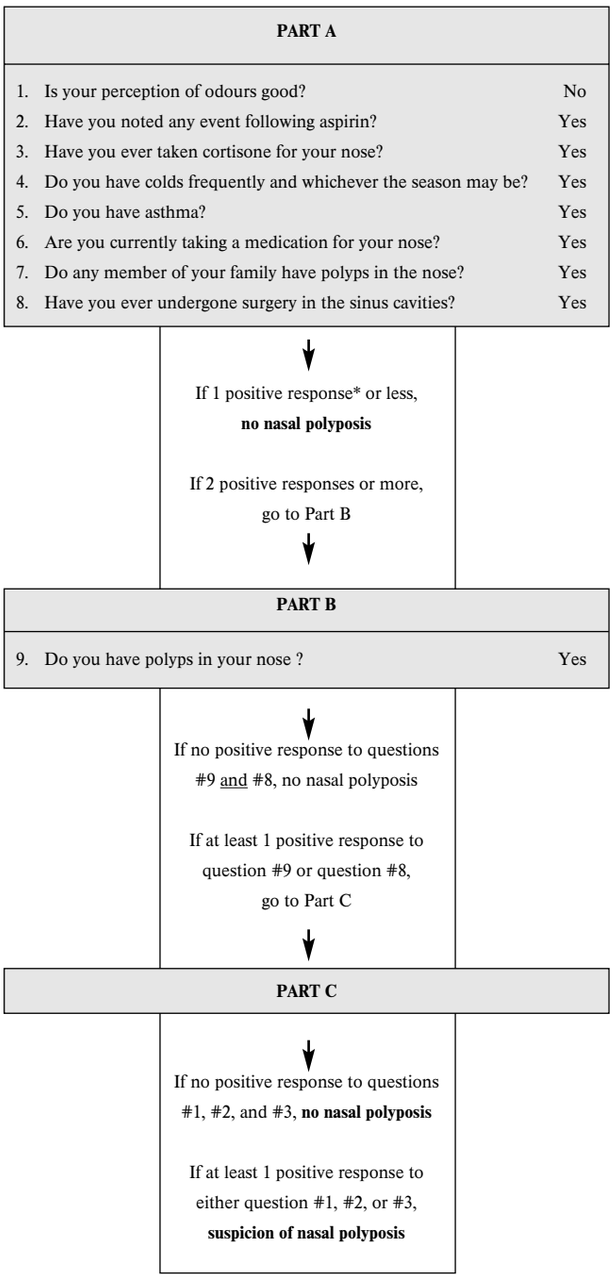
The rate of missing responses was analysed in terms of relationship between the FD and the observed percentage of missing data for each question (Table 2). Rates of non-response ranged from 4% to 21%. The higher rates of missing responses were noted on question #2 on the frequency of blocked nose, and question #6 on previous cortisone therapy (17.5%, and 14.8%, respectively). A high rate of non-response was noted also on question #7 on the existence of a current treatment for nasal affection, especially among the NP subgroup (Table 2). An analysis a posteriori of the questionnaires showed that for these 3 items (questions #2, #6, and #7) the respective sets of sub-questions were completed in about two third of the cases. Overall, no relationship was found between the rate of missing response and the FD, except for the seventh item, i.e., the presence of a treatment for the nasal pathology ($p<0.01$).

Assessment of the sensitivity and specificity of the questionnaire

As shown in Table 3, the questions #10 on the knowledge of actual NP, #6 on previous cortisone therapy for a nasal pathology, and #7 concerning a current treatment for nasal pathology were the most sensitive and specific regarding the FD ($p<0.001$). Among other questions highly related to the FD ($p<0.001$), questions #1 and #8 were somehow less sensitive and specific, and questions #4 and #5 showed high specificity but low sensitivity. Questions #2 concerning the blocked nose and #3 on the frequency of cold occurrence were moderately sensitive and specific ($p<0.01$, and <0.05, respectively), while question #9 (history of broken nose), and #11 (familial history of NP) were shown to be the least sensitive (6.6%, and 14.3%, respectively) despite high specificity (86.4%, and 94.9%, respectively).

The algorithm of diagnostic decision

After the identification of the most discriminating items and in order to ensure a simultaneous good sensitivity and specificity of the inferred algorithm, a 3-part algorithm for NP detection was elaborated by the aggregation of the questionnaire variables, selected on the basis of their respective sensitivity and specificity. Figure 2 presents this diagnostic algorithm.



** positive response: "no" for question #1, "yes" for the other questions*

Figure 2. The 3-part algorithm derived from the questionnaire.

The application of this algorithm to the study population showed that Part A allowed to eliminate 66% of NP-free patients while keeping 95% of patients with a final diagnosis of NP. Part B allowed a further identification of 17% of NP-free patients, while only 1.5% of NP patients were eliminated. Part C led to a specificity of the algorithm = 87.8%, i.e., 301 patients free of NP out of 343, and a sensitivity = 88.9%, i.e., 56 patients in whom NP was detected out of 63.

DISCUSSION

The aim of this validation study was to make available for population-based studies a reliable and easy-to-use diagnostic questionnaire-algorithm allowing the determination of the prevalence of NP in the population in future studies. This goal can be considered successfully reached since the diagnostic algorithm, inferred from the tested questionnaire, was shown to have a very satisfactory specificity and sensitivity, close to 90% (88%, and 89%, respectively).

Positive and negative predictive values were not calculated since the validation test was realized with a non-representative sample with respect to the target population of the questionnaire. Besides, as the prevalence of NP signs is certainly higher among patients consulting ENT hospital departments than among the general population, the sensitivity is likely to be overestimated in this study, and the specificity underestimated. These identified limitations should be ruled out when using the questionnaire in the general population.

In terms of epidemiology, and although it was designed to validate a diagnostic questionnaire rather than to identify epidemiological characteristics of NP, the present study provides some information on the prevalence and management of NP in France. It should be reminded however that the population included in this study is different from the target population (the French general population) to which the questionnaire will be proposed in the prevalence study for which it has been elaborated. The patients who have participated in the present study were all outpatients referred to ENT departments and therefore with a higher risk to present with signs of NP. Nevertheless, although a study conducted in a similar context (hospital ENT departments) reported 4.3% of patients with NP among patients referred to ENT specialists (Settipane, 1977), in our study a meaningful higher proportion (15.5%) of patients with NP was identified by the participating investigators.

The analysis of patients' characteristics, deduced from the responses to the questionnaire, indicates that in NP patients high rates of respiratory disorders were reported as associated and strongly correlated to the NP: anosmia for 65%, frequent blocked nose for 61%, frequent colds for 54%, asthma for 39%. The major part of these patients was actually treated (79%) or had already been treated by specific medication (cortisone for 88%) or sinonasal surgery. Anosmia, despite a mean duration of more than 6 years, was declared likely to be improved by medical treatment by only half of the patients with this disorder.

Aspirin intakes were reported to be associated to undesirable events in a large part (36%) of NP patients; in those patients with NP + asthma (about 40% of the study population), about one third declared their asthma triggered or aggravated by aspirin intakes.

Our results are not in accordance with those of two studies having included populations of patients similar to that of our study, i.e., patients with NP referred to ENT departments (Larsen, 1996) or ENT and allergy specialists (Settipane et al., 1977). In these studies, the reported prevalence of aspirin intolerance was 13% in one study (Larsen, 1996) and 14% in the other one (Settipane et al., 1977) whereas we found aspirin intolerance in 36% of NP patients. Asthma was reported with a prevalence of 30% and 71% (Settipane et al., 1977; Larsen, 1996) while in the present population 40% of asthma prevalence was noted. Such great differences should be elucidated by specific studies.

Despite some limitations, the reported work represents an important step toward the availability of a validated, accurate and simple tool allowing NP detection. As such, this questionnaire and the derived diagnostic algorithm, shown to have a sensitivity and specificity close to 90%, should be very helpful in population-based studies carried-out to assess the prevalence of this disease among the general population, especially in France where no information exists on NP prevalence.

REFERENCES

1. Annesi-Maesano I, Didier A, Klossek M, Chanal I, Moreau D, Bousquet J (2002) The score for allergic rhinitis (SFAR): A simple and valid assessment method in population studies. Allergy 57: 107-114.
2. Burney P, Chinn S (1987) Developing a new questionnaire for measuring the prevalence and distribution of asthma. Chest 91: 79S-83S.
3. De Mantaras RL (1991) A distance based attributes selection measures for decision tree induction. In: Machine Learning 6:81-92.
4. Dykewicz MS, Fineman S, Nicklas R, Lee R, Blessing-Moore J, Li JT, Bernstein IL, Berger W, Spector S, Schuller D (1998) Complete Guidelines of the Joint Task Force on Practice Parameters in Allergy, Asthma and Immunology (1998). Ann Allergy Asthma Immunol 81: 478-518.
5. Dykewicz MS, Fineman S, Nicklas R, Lee R, Blessing-Moore J, Li JT, Bernstein IL, Berger W, Spector S, Schuller D (1998) Joint Task Force Algorithm and Annotations for Diagnosis and Management of Rhinitis. Ann Allergy Asthma Immunol 81: 469-473.
6. Fireman P (1996) Allergic rhinitis. In: Fireman P, Slavin RG, eds. Atlas of allergies, ed 2. London: Mosby-Wolfe, Times Mirror International Publishers Limited: 141-159.
7. Hedman J, Kaprio J, Poussa T, Nieminen MM (1999) Prevalence of asthma, aspirin intolerance, nasal polyposis and chronic obstructive pulmonary disease in a population-based study. Int J Epidemiol 28: 717-722.
8. Jankowski R (1997) Nasal polyposis and asthma. In Nasal Polyposis. An inflammatory disease and its treatment. Niels Mygind and Torben Lildholdt editors. Munksgaard, Copenhagen, 1997, chapter 12, pp 112-119.
9. Kauffmann F, Annesi-Maesano I, Liard R, Paty E, Faraldo B, Neukirch F, Dizier M-H (2002) Construction et validation d'un questionnaire en épidémiologie respiratoire. Rev Mal Respir 19: 323-333.

10. Keith P, Dolovich J (1997) Allergy and nasal polyposis. In Nasal Polyposis. An inflammatory disease and its treatment. Niels Mygind and Torben Lildholdt editors. Munksgaard, Copenhagen, 1997, chapter 7, pp 68-77.
11. Larsen K (1996) The clinical relationship of nasal polyps to asthma. Allergy Asthma Proc 17: 243-249.
12. Medical Research Council's Committee on Research into Chronic Bronchitis. A) Questionnaire on respiratory symptoms; B) Instructions for the use of the questionnaires on respiratory symptoms. WJ Holman, Dawlish, Devon Eds, 1966.
13. Minette A (1989) Questionnaire of the European Community for Coal and Steel (ECSC) on respiratory symptoms. 1987-updating of the 1962 and 1967 questionnaires for studying chronic bronchitis and emphysema. Eur Respir J 2: 165-177.
14. Settipane GA (1996) Epidemiology of nasal polyps. Allergy Asthma Proc 17: 231-236.
15. Settipane GA, Chafee FH (1977) Nasal polyps in asthma and rhinitis: a review of 6037 patients. J Allergy Clin Immunol 59: 17-21.
16. Slavin RG (1997) Nasal polyps and sinusitis. JAMA 278: 1849-1854.
17. The European Community Respiratory Health Survey. "Medicine and Health". EC Directorate General XII. Luxembourg, Office for Official Publications, 1994.
18. Van der Baan B (1997) Nasal Polyposis. Epidemiology and natural history. In Nasal Polyposis. An inflammatory disease and its treatment. Niels Mygind and Torben Lildholdt editors. Munksgaard, Copenhagen, 1997, chapter 1, pp 13-15.

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