
Effect of smoking on symptoms of allergic rhinitis

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Background: Tobacco smoking is common in patients with allergic rhinitis.

Objective: To examine the impact of smoking on allergic rhinitis.

Methods: Two cross-sectional studies (performed between March 1, 2002, and February 28, 2003) assessed the impact of tobacco smoking on the symptoms and quality of life of untreated patients with diagnosed allergic rhinitis who had consulted with primary care physicians (472 patients) and specialists (672 patients). Both studies used the same methods and were combined. Rhinitis was classified according to the Allergic Rhinitis and its Impact on Asthma initiative. The European Community Respiratory Health Survey questionnaire on smoking and the disease-specific Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) were used.

Results: A total of 20.8% of the patients were smokers and 10.9% were ex-smokers. More than 78% of the patients had moderate to severe symptoms of rhinitis. Fewer patients had moderate to severe nasal pruritus or loss of smell. There appeared to be no significant difference in the severity of nasal symptoms, depending on the smoking status. Moderate to severe nasal obstruction was observed in 78.8% of the nonsmokers, 79.0% of the smokers, and 77.4% of the ex-smokers. Overall and individual domain scores in the RQLQ were not altered by the smoking status. The overall median (25th–75th percentiles) RQLQ score was 2.8 (2.1–3.5) in nonsmokers, 2.7 (2.0–3.5) in smokers, and 2.7 (1.9–3.5) in ex-smokers.

Conclusions: In the present study, which was performed with a large number of untreated patients with a diagnosis of allergic rhinitis, smoking was found not to alter nasal symptoms or nasal-specific quality of life.

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INTRODUCTION

The Allergic Rhinitis and its Impact on Asthma (ARIA) recommendations have devised a new classification for *allergic rhinitis*.¹ *Intermittent* and *persistent rhinitis* were proposed to replace *seasonal* and *perennial allergic rhinitis*, and it was shown that these terms are not synonymous.² It is now recognized that allergic rhinitis comprises more than the classic symptoms of sneezing, rhinorrhea, and nasal obstruction. Allergic rhinitis is now associated with impairments in how patients function in day-to-day life at home, work, and school.^{3,4} Patients with allergic rhinitis are impaired in physical and mental functioning, including vitality and the perception of general health.⁵ Patients may also be bothered by sleep disorders, emotional problems, impairment in activities, and social functioning.⁶

Tobacco smoking is common in patients with allergic rhinitis. Smoking inconsistently increases total and specific IgE levels^{7–11} and the IgE sensitization to some occupational

allergens.¹² In healthy individuals, smoking does not impair nasal quality of life (QOL).¹³ Few studies have examined the relationship between tobacco smoking and the prevalence of rhinitis, and no clear-cut result has been observed.^{14–19} In 3 studies, the prevalence of self-reported nasal allergy symptoms was lower in smokers than in nonsmokers.^{10,14,15} In 1 study involving adolescents, smoking was found to increase the prevalence of rhinoconjunctivitis.¹⁹ Tobacco smoking may induce nasal symptoms, causing headache and nose irritation, characterized by rhinorrhea, nasal congestion, post-nasal drip, and sneezing.^{20,21} However, the effects of smoking on symptoms of allergic rhinitis and disease-specific QOL measures are unknown.

The aim of this cross-sectional study was to evaluate the impact of tobacco smoking on the symptoms and QOL scores of untreated patients with allergic rhinitis consulting with primary care physicians (study 1: 483 patients) and specialists (study 2: 693 patients). The 2 arms of the study used the same methods. Because chronic obstructive pulmonary diseases induced by tobacco smoking may considerably alter QOL, the disease-specific Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) was implemented.⁶

METHODS

Patients

Patients were included in the study after written informed consent was obtained and after approval of the protocol by the Ethics Committee of Montpellier, France. All patients

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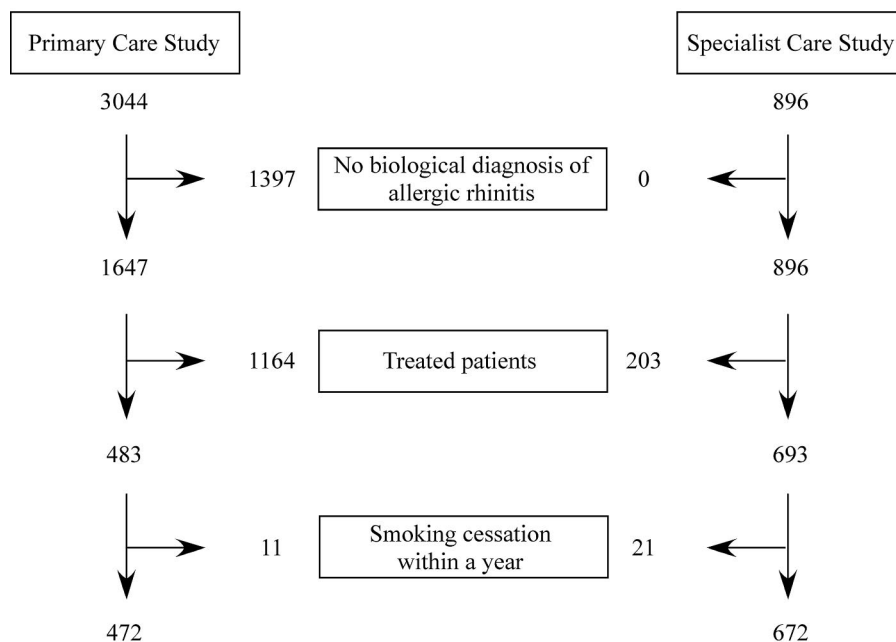


Figure 1. Flowchart of patients selected from the primary and specialist care studies.

fulfilled the following inclusion criteria. First, patients had at least a 3-year history of allergic rhinitis diagnosed according to the International Consensus on Rhinitis.³ Second, the diagnosis of allergy was made using skin prick tests with standardized allergens (Stallergènes SA, Fresnes or Allerbio, Varenne-en-Argonne, France) or serum specific IgE (Pharmacia CAP System)²³ or Phadiatop,²⁴ all performed within the past 5 years. The positivity of allergen specific IgE correlated with the timing of symptoms and exposure. The range of allergens tested in skin prick tests or serum specific IgE covered patients' sensitivities commonly observed in France. Third, patients did not receive any rhinitis treatment at inclusion.

Study Design

In France, most patients consulting a physician for treatment of allergic rhinitis have moderate to severe symptoms,²⁵ and this is particularly true for those consulting specialists.²⁶ To have a sufficient number of patients with intermittent and persistent rhinitis, we selected those from primary and specialist care (Fig 1). Two studies using identical methods in which smoking was evaluated as a secondary end point were used, and the results were averaged. Patients were asked to fill in the questionnaires and to mail them back to the central monitoring office. More than 90% of the patients returned the questionnaires in the 2 studies, and only these 1,144 patients were included in the study.

In the first study designed to evaluate the validity of the ARIA classification, 3,044 patients with a clinical diagnosis of allergic rhinitis were recruited from primary care practices for 1 year (March 1, 2002, through February 28, 2003). These

patients were recruited from all regions of France to prevent seasonal or regional differences. Physicians were randomly selected from the entire list of French general practitioners. Each physician enrolled 4 consecutive patients. The 483 untreated patients with a proven diagnosis of allergy were included in the present study. Eleven of the patients who had stopped smoking within the last 12 months were not included in the analysis. No statistically significant differences were found in sex, smoking status, ARIA scores, and global RQLQ score between the patients who were recruited and those who were not. However, a statistically significant difference in age was found (recruited patients: mean age, 40.3 years; age range, 30.2–52.1 years; nonrecruited patients: mean age, 36.5 years; age range, 26.7–47.4 years; $P = .005$, χ^2 test) and socioeconomic status ($P = .003$, χ^2 test).

In the second study designed to evaluate the efficacy of the ARIA management program in allergic rhinitis (unpublished data), 896 patients were recruited from specialist practices (allergists, chest physicians, and otorhinolaryngologists) with a diagnosis of pollen rhinitis (mainly due to grass pollen). Patients were recruited from March 1, 2002, through July 31, 2002, during the pollen season and were selected from all regions of France. All physicians in France were randomly selected from the entire list of French specialists, but only 1 physician per group practice was selected. Each physician enrolled 2 consecutive patients. The 693 untreated patients were included in the present study. Twenty-one of the patients who had stopped smoking within the last 12 months were not included in the analysis. No significant difference was found in age, sex, smoking status, ARIA scores, and

global RQLQ score between the patients who were recruited and those who were not.

Smoking Questionnaire

The questionnaire used on smoking is part of the European Community Respiratory Health Survey²⁷ and differentiates between current smokers and those who previously smoked.^{28–30} Patients were classified as light (<10 g of tobacco per day), medium (10–19.9 g of tobacco per day), or heavy smokers (>20 g of tobacco per day). Patients were considered to be ex-smokers if they had stopped smoking for more than 12 months. Patients who had stopped smoking within the last 12 months were not included in the analysis.

Evaluation of Severity of Rhinitis

Patients were placed into 4 groups (mild intermittent, moderate to severe intermittent, mild persistent, and moderate to severe persistent rhinitis) according to the ARIA classification.¹ Individual rhinitis symptoms (eg, nasal obstruction, rhinorrhea, sneezing) were quoted on a 4-point scale from 0 (none) to 3 (severe) according to a previous study.³¹ Because the subjective evaluation of symptoms may vary among patients, we averaged moderate (score 2) and severe (score 3) symptoms and analyzed them for the impact of smoking.

Rhinoconjunctivitis Quality of Life Questionnaire

Patients' QOL was evaluated using the disease-specific RQLQ.⁶ The RQLQ provides an overall score and individual scores in 7 domains: limitation of activities, sleep, non-hay fever symptoms, practical problems, nasal symptoms, eye symptoms, and emotions. In this questionnaire, patients rate

the degree of impairment during the preceding week by responding to each of 28 items using a 7-point scale on which a score of 0 indicates "no impairment" and a score of 6 "maximal impairment."

Statistical Analysis

Although some of the variables are normally distributed, others are not. We therefore chose to use nonparametric statistics for all the variables, and results are expressed in medians (25th to 75th percentiles). Differences between cases and controls were tested for statistical significance using the χ^2 test for qualitative variables and the Mann-Whitney test or Kruskal-Wallis test with Bonferroni-Dunn post hoc analyses for quantitative variables. Statistical analysis was performed with SAS statistical software (SAS Institute Inc, Cary, North Carolina). The *P* value was set at < .05.

RESULTS

Demographic Characteristics of Patients and Smoking

The demographic characteristics of the patients are presented in Table 1. No significant differences exist between the 2 arms of the study. Smoking patterns are presented in Table 2. Smokers were usually smoking fewer than 10 cigarettes a day.

Distribution of Patients Into the 4 ARIA Classes

In the primary care arm, 4.5% of the patients could not be classified and were excluded from the analysis. Forty-seven percent of the patients had intermittent rhinitis, and more than 90% had moderate to severe rhinitis (Table 1). In the spe-

Table 1. Demographic Characteristics of the Patients

Characteristics	Primary care group (n = 472)	Specialist practice group (n = 672)	<i>P</i> value ^a
Age, median (25th–75th percentiles), y	36 (26–47)	35 (26–43)	.15
Males, No. (%)	219 (46.4)	301 (44.8)	.87
Socioeconomic status, No. (%)			<.02
Farmer	12 (2.6)	5 (0.7)	
Craftsman, shopkeeper	20 (4.3)	41 (6.1)	
Worker, employee	156 (33.1)	245 (36.6)	
Executive	137 (29.1)	210 (31.3)	
Unemployed	88 (18.8)	78 (11.6)	
Other	57 (12.1)	92 (13.7)	
Headache, No. (%)	221 (47.0)	296 (44.1)	.41
Smoking status, No. (%) ^b			<.04
Nonsmokers	337 (71.4)	428 (66.2)	
Ex-smokers	54 (11.4)	68 (10.4)	
Smokers	81 (17.2)	151 (23.4)	
ARIA class, No. (%) ^c			<.001
Mild intermittent rhinitis (MI)	13 (2.9)	60 (9.0)	
Moderate to severe intermittent rhinitis (SI)	200 (44.3)	132 (19.7)	
Mild persistent rhinitis (MP)	13 (2.9)	78 (11.6)	
Moderate to severe persistent rhinitis (SP)	225 (49.9)	400 (59.7)	

Abbreviation: ARIA, Allergic Rhinitis and its Impact on Asthma.

^a For qualitative variables the χ^2 test was used; for quantitative variables the Mann-Whitney test was used.

^b Difference only between smokers and nonsmokers (*P* = .01, in post hoc analysis).

^c Differences between MI and SI, SI and MP, SI and SP, and MP and SP (*P* < .001 in post hoc analysis).

Table 2. Smoking Characteristics of the Patients

Characteristics	Smokers	Ex-smokers	P value ^a
Patients, No. (%)	232 (20.8)	122 (10.9)	
Starting age of smoking, median (25th-75th percentiles), y	17 (16-19)	17 (16-18)	>.99
Daily cigarette consumption, median (25th-75th percentiles), g of tobacco	10 (5-15)	15 (10-20)	<.01
Smoking cessation, median (25th-75th percentiles), y		9 (5-15)	
Smoke inhalation, No. (%)	186 (82.0)	98 (81.4)	.86
Duration of smoking, median (25th-75th percentiles), y	12.5 (6.0-20.0)	12.0 (6.5-20.0)	.75
Characterization of smokers, No. (%)			<.001
Light (<10 g per day)	211 (91.2)	90 (74.2)	
Medium (10-19.9 g per day)	13 (5.5)	13 (10.5)	
Heavy (>20 g per day)	8 (3.3)	19 (15.3)	

^a For qualitative variables the χ^2 test was used; for quantitative variables the Mann-Whitney test and the Kruskal-Wallis tests were used.

cialist practice arm, 0.3% of patients could not be classified and were excluded from the analysis. Twenty-eight percent of the patients had intermittent rhinitis, and approximately 80% had moderate to severe rhinitis. A significant difference was found between groups ($P = .01$, χ^2 test), with more patients with intermittent rhinitis in the primary care patient group. No significant difference existed between nonsmokers and smokers, but ex-smokers more often had mild persistent rhinitis than the patients of the other 2 groups.

Individual Symptom Scores

Most patients had moderate to severe symptoms for nasal obstruction, rhinorrhea, and sneezing. Fewer patients had moderate to severe nasal pruritus. No significant difference was found for the severity of nasal symptoms in smokers or ex-smokers (Table 3).

Quality of Life

The RQLQ was filled in correctly (ie, between 85.2% and 90.3% of the questions of the different domains were answered) by 666 of 782 nonsmokers, 203 of 238 smokers, and 103 of 124 ex-smokers, and these patients were considered for RQLQ analysis. Overall and individual domain scores in the RQLQ were not altered by the smoking status (Table 4).

DISCUSSION

Even though observational studies have some limitations and cannot certify the absence of a relationship, the present study, which was performed with a large number of untreated patients with a diagnosis of allergic rhinitis, found that smoking does not alter nasal symptoms or nasal-specific QOL. The diagnosis of allergic rhinitis is rarely difficult in pollen al-

Table 3. Impact of Smoking on Symptoms

Symptoms	Nonsmokers, No. (%) (n = 765)	Smokers, No. (%) (n = 232)	Ex-smokers, No. (%) (n = 122)	P value ^a
Nasal obstruction				.51
No symptoms	31 (4.1)	16 (6.9)	7 (5.7)	
Mild	130 (17.0)	32 (13.8)	21 (17.2)	
Moderate	314 (41.1)	93 (40.1)	53 (43.4)	
Severe	289 (37.8)	91 (39.2)	41 (33.6)	
Rhinorrhea				.95
No symptoms	26 (3.4)	8 (3.4)	2 (2.5)	
Mild	112 (14.6)	33 (14.2)	18 (14.8)	
Moderate	364 (47.6)	118 (20.9)	63 (51.6)	
Severe	263 (34.4)	73 (31.5)	38 (31.1)	
Sneezing				.75
No symptoms	15 (2.0)	5 (2.2)	5 (4.1)	
Mild	160 (20.9)	50 (21.6)	27 (22.1)	
Moderate	372 (48.7)	114 (49.1)	62 (50.8)	
Severe	217 (28.4)	63 (27.2)	28 (23.0)	
Pruritus				.07
No symptoms	103 (13.4)	41 (17.7)	24 (19.8)	
Mild	237 (31.0)	86 (37.1)	38 (31.4)	
Moderate	302 (39.5)	75 (32.3)	47 (38.8)	
Severe	123 (16.1)	30 (12.9)	12 (10.0)	

^a P value by contingency table analysis.

Table 4. Results of the RQLQ^a

	Nonsmokers (n = 666)	Smokers (n = 203)	Ex-smokers (n = 103)	P value ^b
Global RQLQ score	2.8 (2.1–3.5)	2.7 (2.0–3.5)	2.7 (1.9–3.5)	.54
Sleep	2.3 (1.0–3.7)	2.2 (0.7–3.7)	2.3 (1.0–3.7)	.43
Non-hay fever symptoms	2.1 (1.1–3.1)	2.1 (1.1–3.3)	2.0 (1.0–3.0)	.46
Practical problems	4.0 (3.0–5.0)	4.0 (3.0–5.0)	4.0 (3.0–4.7)	.48
Nasal symptoms	3.7 (2.7–4.5)	3.5 (2.7–4.5)	3.7 (2.5–4.5)	.96
Eye symptoms	2.0 (0.7–3.5)	2.0 (0.7–3.2)	2.0 (1.0–3.5)	.78
Emotions	2.7 (1.7–3.5)	2.5 (1.5–3.5)	2.5 (1.5–3.5)	.56

Abbreviation: RQLQ, Rhinoconjunctivitis Quality of Life Questionnaire.

^a The 2 patient groups were averaged. Results are expressed in medians (25th–75th percentiles).

^b P value by Kruskal-Wallis test.

lergy but may be more difficult for allergy to indoor allergens. For the diagnosis of rhinitis, we used the simple questionnaire of the International Consensus on Rhinitis.³ For the diagnosis of allergy to pollens and/or indoor allergens, skin prick tests and/or serum specific IgE measurement was used because IgE and skin prick tests have been shown to have equal efficiency.³² We did not perform intradermal skin tests because they were shown to add little to the diagnostic evaluation.³³ Some patients only underwent a Phadiatop test because this test can efficiently discriminate allergic and nonallergic individuals in France.³⁴

The classification of the duration of rhinitis symptoms was made according to ARIA into 4 categories.¹ In this study, most patients presented moderate to severe symptoms. The selection of patients in specialist practices was thought to be more likely to increase the prevalence of moderate to severe persistent rhinitis, whereas the selection of patients in primary care was thought to increase the prevalence of intermittent rhinitis. The results of the study confirmed this proposal, but more patients than expected had moderate to severe disease in both groups, especially in the primary care group. These results suggest that when patients consult with physicians for treatment of allergic rhinitis, they usually have severe and/or persistent symptoms.

For many years, it has been recognized that seasonal and perennial allergic rhinitis impairs QOL.^{5,6} In the present study, we could not use a generic QOL questionnaire because many smokers with chronic obstructive pulmonary disease have an impaired QOL due to bronchitis and/or emphysema. However, the Juniper RQLQ is suitable for the study because it is a disease-specific QOL questionnaire. Interestingly, the median overall RQLQ value is similar to previous studies in primary care.³⁵

In the present study, the prevalence of smoking in patients with rhinitis who consult with primary care physicians or specialists is slightly lower than the reported smoking rate in France. In 1999, the estimated prevalence of smokers was 34.2%,³⁶ but, in this study, ex-smokers and smokers were not differentiated. Tobacco does not increase the severity of nasal symptoms. The same prevalence of moderate to severe nasal obstruction, rhinorrhea, sneezing, nasal pruritus, or headache

was found among smokers, ex-smokers, and nonsmokers. Thus, although tobacco smoking is thought to induce nasal symptoms,²⁰ such effects were not observed in a large population of patients with allergic rhinitis. Furthermore, in heavy smokers, no difference was found. Thus, the fact that patients were not heavy smokers did not appear to change the results. These results may be surprising because the nasal mucosa of smokers is altered by comparison with healthy individuals, even in individuals who smoke fewer than 20 cigarettes a day.³⁷

Nasal-specific QOL was unaltered by smoking, and this study confirms a pilot study performed on a small sample of smoking and nonsmoking patients with allergic rhinitis.¹³ In the same study,¹³ we found that smoking was not inducing nasal symptoms and that QOL was similar in smokers and nonsmokers. However, the present study was not designed to differentiate smokers from patients with chronic obstructive pulmonary disease; therefore, we cannot compare impairments of QOL in nasal and bronchial diseases.³⁸

The reasons explaining the lack of effect of smoking on the nasal symptoms of patients with allergic rhinitis are not clear. However, most smokers do not have bronchial symptoms, whereas they have an abnormal bronchial mucosa and may even have an impaired pulmonary function. Thus, it is not unexpected that smokers who have an abnormal nasal mucosa may not experience nasal symptoms. It may have been expected that smokers would have an increased mucous secretion, but this was not found in the study.

In conclusion, this study has important clinical implications because approximately 20% of patients with allergic rhinitis smoke. This study shows that smoking is not associated with differences in the severity or type of nasal symptoms.

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