

The relationship between atopy and chronic rhinosinusitis

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ABSTRACT

Background: The aim of this study was to determine whether atopy influences either clinical and radiological severity or surgical revision rates in patients with chronic rhinosinusitis (CRS).

Methods: Patients who had been scheduled for endoscopic sinus surgery were classified as having CRS or nasal polyposis. Their atopic status was determined by ImmunoCAP testing. Disease severity was assessed clinically by the Lund symptom and Sino-Nasal Outcome Test 20 (SNOT-20) quality-of-life scores and radiologically by the Lund-Mackay CT score.

Results: One hundred ninety-three consecutive patients with rhinosinusitis were included in the study. The prevalence of atopy in this group was found to be 30%. No association was found between atopic status and Lund symptom scores. Analysis of the SNOT-20 scores indicated that atopic patients had higher sneezing scores ($p < 0.03$), reduced productivity ($p < 0.01$), and reduced concentration ($p < 0.01$). The mean CT score was significantly higher in the atopic patients than in nonatopic patients overall (14.2 ± 1.6 versus 12.2 ± 1.3 ; $p = 0.05$), although within each of the clinical subgroups no statistically significant relationship was observed between a patients' atopic status and their CT scores. The rate of revision surgery was not significantly different between atopic and nonatopic patients.

Conclusion: These results suggest that atopic status has minimal impact on the severity of CRS.

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The pathogenesis of chronic rhinosinusitis (CRS) is complex and multifactorial. It is an inflammatory condition and recent studies have suggested that fungi, staphylococcal superantigens, and bacterial biofilms may play a role in provoking mucosal inflammation.^{1–3} Although it would appear plausible that allergic rhinitis predisposes to CRS by obstructing the sinus ostia, the relationship between allergic rhinitis, atopy, and CRS remains ill defined. Some studies have suggested that atopic patients with CRS suffer more severe symptoms and higher CT scores and are more likely to have worse outcomes after surgery.^{4–6} However, other studies have failed to establish a clear relationship between the prevalence and/or severity of CRS and the atopic status of the patient.^{7,8}

Part of the difficulty in establishing the role of atopy in the pathogenesis of CRS has been inconsistency in the definition of allergy and atopy. Atopy is a state in which specific IgE antibodies to common aeroallergens are produced that may be detected by skin-prick or Radio Allergo Sorbent Test. The prevalence of atopy in the healthy Australian population has been found to be 45%.⁹ Because the prevalence of allergic rhinitis in Australia is ~15–20%, this implies that only a subset of atopic individuals (approximately one-third) develop allergic rhinitis.¹⁰ Making a diagnosis of allergic rhinitis in a patient with CRS can be difficult because these two conditions have symptoms in common such as nasal obstruction and rhinorrhea. However, atopic status can be determined objectively in patients with CRS, which allows the relationship between CRS and atopy to be determined more

easily than that between CRS and allergic rhinitis. The aim of this study was to determine the association between a patient's atopic status and the clinical and radiological severity of CRS and the need for revision surgery.

METHODS

After obtaining approval from the Ethics Committee, all patients undergoing endoscopic sinus surgery for rhinosinusitis at the Queen Elizabeth Hospital between March 1999 and November 2003 were included in the study. The patients were grouped into one of two categories according to their clinical presentation and radiological findings: CRS without nasal polyposis or CRS with nasal polyposis.¹¹ All patients had been treated medically before being considered for endoscopic sinus surgery. Medical management generally consisted of a 3-week reducing course of oral prednisolone followed by at least 10 weeks of treatment with a topical nasal corticosteroid spray and nasal saline irrigation. A 2- to 3-week course of antibiotics was added if purulent secretions were visualized on nasendoscopy.

Symptoms were assessed by asking patients to complete both the Lund and the Sino-Nasal Outcome Test 20 (SNOT-20) symptom score systems.^{12,13} A serum sample was analyzed for aeroallergen-specific IgE using the ImmunoCAP system (Pharmacia, Stockholm, Sweden). The allergens tested for were house-dust mites, mixed molds, grass pollens, and cat and dog dander. Preoperative CT scanning of the sinuses was performed on all patients and these were scored using the Lund-Mackay system.¹⁴ Data are presented as means $\pm$ SE of the means. Statistical analysis was performed using SPSS software (SSPS, Inc., Chicago, IL).

RESULTS

One hundred ninety-three patients were eligible for inclusion into the study. There were 125 (64%) men and 68 (36%) women. The mean age at the time of surgery was 47.5 years.

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Prevalence of Atopy

Overall, the prevalence of atopy in the patient group was 30%. Table 1 shows the prevalence of atopy in each of the two sinusitis subgroups. A χ^2 -square analysis showed a higher prevalence of atopy in the patients with CRS without polyposis (Table 1).

Symptoms: SNOT

A preoperative SNOT-20 score was completed by all patients. The percentage of patients who found a particular symptom important to them was compared in the atopic and nonatopic groups (Table 2). It was found that the patients who were troubled by sneezing, reduced productivity, and reduced concentration were more likely to be atopic.

Lund Symptom Score

This visual analog score asked patients to rate the severity of the following symptoms: nasal blockage, headache, facial pain, alteration in the sense of smell, nasal discharge, sneezing, and overall rating of nasal symptoms. The symptoms

scores for each patient were added to give a sum that reflected the total symptom severity for each patient. Table 3 compares the total symptom scores for each of the sinusitis subgroups according to their atopic status. In none of the subgroups did the atopic status have a significant effect on symptom severity.

CT Scores

The mean Lund-Mackay score was 14.2 ± 1.6 in the atopic patients and 12.3 ± 1.4 in the nonatopic patients ($p = 0.05$). The CT scores were higher in the patients with CRS and polyposis than CRS without nasal polyposis ($p = 0.02$). In none of the sinusitis subgroups was the score significantly different in atopic as opposed to nonatopic patients (Table 4).

Revision Surgery

A total of 89 patients (43%) underwent revision surgery (Table 5). Patients with CRS with polyposis had a significantly higher rate of revision surgery ($p = 0.05$). The rate of revision surgery was not significantly different between atopic and nonatopic patients.

Table 1 Prevalence of atopy in the sinusitis subgroups

Sinusitis Subgroup	n	Atopy (%)	p Value
CRS without polyposis	127	32.3	0.050
CRS with polyposis	66	27.5	0.785
Total	193	30.1	

Table 2 SNOT-20 responses according to atopic status

Symptom	No. of Patients Stating Symptom Important	Atopic Patients	Nonatopic Patients	p Value
Need to blow nose	43	11	32	NS
Sneezing	14	7	7	0.040
Runny nose	30	8	22	NS
Cough	14	5	9	NS
Postnasal discharge	35	11	24	NS
Thick nasal discharge	26	8	18	NS
Ear fullness	8	3	5	NS
Dizziness	10	1	9	NS
Ear pain	4	1	3	NS
Facial pain/pressure	36	10	26	NS
Difficulty falling asleep	20	7	13	NS
Wake up at night	22	7	15	NS
Lack of a good night's sleep	29	10	19	NS
Wake up tired	22	6	16	NS
Fatigue	13	5	8	NS
Reduced productivity	5	4	1	0.006
Reduced concentration	9	7	2	0.002
Frustrated/restless/irritable	23	8	15	NS
Sad	4	2	2	NS
Embarrassed	7	1	6	NS

DISCUSSION

This series is one of the largest to compare the clinical and radiological severity and rate of revision surgery in CRS patients with and without atopy. It has been found that the patients' atopic status has little influence on disease severity or their rate of revision. This relationship holds true for each of the two clinical subgroups into which our study patients were classified. There are several studies suggesting an association between allergic rhinitis and/or allergy and CRS.^{4-6,15}

Table 3 Symptom severity, as measured by the Lund symptom score, in each of the sinusitis subgroups according to atopic status

Sinusitis Subgroup	Atopic		Nonatopic		<i>p</i> Value
	<i>n</i>	Lund Score	<i>n</i>	Lund Score	
CRS without polyposis	40	7.5	87	9.0	NS
CRS with polyposis	18	7.9	48	8.1	NS
Total	58	7.8	135	8.6	NS

Table 4 CT scores in the sinusitis subgroups according to atopic status

Sinusitis Subgroup	Atopic		Nonatopic		<i>p</i> Value
	<i>n</i>	CT score	<i>n</i>	CT Score	
CRS without polyposis	40	12.50	87	11.51	NS
CRS with polyposis	18	16.87	48	17.55	NS
Total	58	14.20	135	12.30	0.05

Table 5 Rate of revision surgery in the sinusitis subgroups according to atopic status

Sinusitis Subgroup	Total Revision Rate	Atopic Revision Rate	Nonatopic Revision Rate	<i>p</i> Value
CRS without polyposis	41/127	33%	30%	NS
CRS with polyposis	42/66	55%	66%	NS
Total	83/193	38%	45.2%	NS

It has been suggested that allergic mucosal edema may compromise sinus drainage and ventilation, promoting mucous retention, ciliary dysmotility, and secondary bacterial growth but conclusive evidence for this pathogenic pathway is lacking.¹⁶

A distinction must be drawn between allergic rhinitis and atopy. We made no attempt to determine whether our atopic patients did indeed have clinical manifestations of their atopy (*i.e.*, had allergic rhinitis). We contend that it is difficult to make a certain diagnosis of perennial allergic rhinitis in patients with CRS because of the overlap in symptoms. The use of atopy as a variable may have consequently resulted in an underestimation of the role of allergic rhinitis in CRS because only about one-third of atopic subjects have allergic rhinitis.

It is notable that the prevalence of atopy in this study population (30%) was lower than that in a normal population, which has been previously measured using very similar methodology—the prevalence of atopy in a large group of normal volunteers in Melbourne (a city on the same latitude as Adelaide with a similar climate and ethnic composition) was 45%.⁹ Other studies have reported a high frequency of atopy in CRS patients of up to 78%.¹⁵ The reason for the significant disparity between the rate of atopy in this study and that reported in previous series is not obvious. Significant geographic variation has been described in the prevalence of allergic fungal sinusitis.¹⁷ The frequency of atopy in CRS possibly may vary also over different study populations.

Symptoms scores measured by the Lund scoring system were not affected by atopic status as were most of the indi-

vidual symptoms graded by the SNOT-20 questionnaire with the exception of sneezing, reduced productivity, and concentration. These data suggest strongly that CRS patients generally are not more symptomatic if they are atopic. Another marker of disease severity is the surgical revision rate. In this study the rate of revision surgery was not different between the atopic and nonatopic patient groups. Again, our findings are at variance with several previously published series in which atopic CRS patients tended to have more severe disease.⁴⁻⁶

CT scans were used as an objective measure of mucosal disease. The scans were scored according to the validated system of Lund and Mackay.¹⁴ As may be expected, patients with a diagnosis of CRS with nasal polyposis had significantly higher CT scores than those with CRS without polyposis. Patients with atopy showed slightly greater radiological severity than nonatopic patients, which approached statistical significance ($p = 0.05$). These results are consistent with some published series that have suggested atopic patients with CRS have worse CT scores than nonatopic patients with the same disease.^{4,6} CT stage has been shown, however, to predict poorly clinical severity in CRS and the disparity in the effect of atopy on clinical severity and radiological severity is not unexpected.¹⁸

In this study we have shown that the clinical features of CRS are not influenced by atopy. This raises the question as to whether atopy is important in the pathogenesis of CRS. Recent evidence suggests that mucosal hypersensitivity, probably to fungal allergens, may be playing a more important

causative role than systemic allergy.^{19,20} Other putative pathogenetic mechanisms such as local immune responses to staphylococcal superantigens or biofilms also are likely to be independent of a patient's atopic status.^{2,3}

CONCLUSION

Our study indicates that a patient's atopic status has no impact on sinus disease severity as measured by symptom and quality-of-life scores and the need for surgical revision but has a modest effect on the radiological severity of the disease. These findings suggest that atopy may not play an important role in the pathogenesis of CRS and imply that allergy-specific treatments may not be effective in most patients with CRS.

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