

Clinical presentation of chronic non-infectious rhinitis in children

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Chronic rhinitis is one of the commonest conditions affecting humans and there is evidence that its prevalence (and especially that of allergic rhinitis) is increasing. Although common, it is poorly recognised by doctors, parents and patients, particularly in children.

Aims. This study surveyed children with chronic non-infectious rhinitis to describe their presenting symptoms, differences in presentation between preschool and school-aged children and the prevalence of complications.

Subjects and methods. We prospectively surveyed patients with a diagnosis of chronic rhinitis that was subsequently confirmed by response to therapy. Symptoms of rhinitis were assessed via an interview-conducted questionnaire.

Results. 567 children (357 boys), with a mean age (\pm SD) of 5.3 ± 3.6 years, were studied over 14 months. Three hundred and fourteen were preschool children. Symptoms of a blocked or a runny nose were reported in 85% of patients, both symptoms occurring simultaneously in 59.9%. A blocked nose occurred more frequently in school-aged children, while a runny nose was commoner in preschool children. Sneezing and itch occurred less frequently in 56.1% and 33.6%, respectively. Complicating recurrent ear infections were reported in 46.9% of patients, more frequently in preschool children ($P = 0.01$); almost one-third (32.02%) had had grommets inserted. Learning problems, possibly secondary to somnolence as a result of poor sleep induced by sleep apnoea (snoring was reported in 58.4%), were reported in 24.1% of school-going children.

Conclusion. As chronic rhinitis in South Africa commonly manifests with a blocked nose, patients display a high prevalence of associated complications. Doctors need to be aware of the presenting symptoms to diagnose and treat chronic non-infectious rhinitis earlier to prevent these complications.

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Chronic rhinitis is one of the commonest chronic diseases experienced by humans.¹ Depending on the community under study, it has been variably described as affecting between 4.5%² and 38.3%³ of the population. It is estimated that at least 25 - 30 million in the USA suffer from allergic rhinitis and that it alone accounts for an astounding 2.5% of all doctor visits for all disease.⁴ It occurs in 75% of children with asthma, which itself is a very common condition.⁵ In southern Africa it is estimated to affect 20% of children.⁶

Although chronic (non-infectious) rhinitis is very common, and recent evidence suggests that the prevalence may even be increasing,⁷⁻⁹ it remains poorly recognised and treated. Possible explanations may be that despite being a troublesome disease, it is often not taken seriously enough by patients, their parents and doctors⁵ or that diagnosis relies on a symptom complex that may be difficult to recognise because it varies in severity.¹⁰ For example, surveys of 'normal' subjects thought not to suffer from rhinitis have shown that 40% had experienced nasal symptoms the previous day.¹¹ This failure to recognise chronic, especially allergic, rhinitis occurs more frequently in children, especially young children; the rhinitic symptoms are frequently attributed to recurrent viral infectious rhinitis and these 'colds' are themselves common in this age group. The mean frequency of the common cold in children 2 - 6 years of age is 6 per year.¹⁰

In this prospective survey of children in whom chronic rhinitis was diagnosed, we describe their presenting symptoms, differences in presentation between preschool (< 5 years old) and school-aged children, and the prevalence of complications.

Subjects and methods

We prospectively studied 567 children consecutively attending an allergy practice during the 14-month period from October 1994 to November 1995. Subjects were included in the analysis if, at their initial visit, they were diagnosed as having chronic non-infectious rhinitis and if, at follow-up, they were shown to have responded to topical (anti-inflammatory) treatment.

Chronic rhinitis was diagnosed if symptoms attributable to the nose were present for more than 1 hour on most days¹⁰ in the year. This category of conditions encompassed allergic rhinitis but also in some cases chronic rhinitis of irritant or idiopathic cause (vasomotor rhinitis). Response to medical anti-inflammatory treatment was important to exclude tumours, anatomical disorders and systemic disease with nasal symptoms. In the diagnosis of allergic rhinitis, confirmatory factors such as a history or clinical evidence of other allergic conditions (e.g. asthma), a family history of atopy as well as previous allergy skin-prick tests were also considered in the diagnosis. Allergic rhinitis was diagnosed in patients with chronic symptoms of rhinitis with an allergic diathesis proven by skin-prick test sensitivity (2 mm greater than negative control) to one or more relevant common allergens or by positive Phadiatop, elevated IgE levels for age or a positive radio-allergosorbent test (RAST) (again, to the relevant common allergen). The study population was not stratified by aetiology of chronic rhinitis; however, allergic rhinitis was by far the commonest cause.

Therapy consisted mainly of topical corticosteroids, with or without antihistamines. Allergen avoidance, although attempted, and specific immunotherapy (where indicated) were successful in a minority of patients. Where allergic rhinitis was present, only patients with perennial symptoms were included.

Clinical data were recorded at the patient's initial visit by means of a questionnaire. The questionnaire interview was personally conducted by the two investigators (RG and DL). Questions were derived from texts that described the presenting symptoms of chronic rhinitis¹²⁻¹⁴ in an attempt to make the questionnaire as inclusive and complete as possible. The questionnaire recorded patient demographic data such as sex and age. The nasal symptoms and complications of chronic rhinitis enquired about included principal nasal symptoms (blocked nose, runny nose, sneezing and itching), associated symptoms (recurrent epistaxis, snoring, restless sleep, excessive tiredness during the day, irritability in the afternoon, post-nasal drip, frequent stomach aches, frequent sore throats, halitosis and frequent or persistent 'colds'), associated signs of oedematous nasal mucosa, the 'allergic facies' (rings or bags under eyes, constant rubbing of the nose, mouth breathing) and, lastly, related problems such as learning difficulties or problems at school, recurrent ear problems, recurrent tonsillitis, tonsillectomy, adenoidectomy, grommets, sinus headaches and sinus operation. A history of other allergic conditions (asthma, eczema) in the patient and a family background of atopy (asthma, allergic rhinitis or eczema) in first-degree relatives were also elicited.

As patients with chronic rhinitis have been classified into two categories, 'blockers' (predominantly blocked nose) and 'runners' (predominantly runny nose),^{10,15} we assessed the relative frequency of either or both of these principal symptoms in our patients.

Statistical analysis was performed by means of the Z-test, given the large sample size, for comparison of individual symptoms. Statistical significance was established at the 5% significance level. In addition the two groups (preschool and school-aged children) were compared as a whole for each complex of symptoms. In this case a contingency table analysis was performed by means of the chi-square test. A *P*-value was obtained by comparing the test statistic to a critical value for each of the contingency tables.

Results

Of the 567 children studied, 314 (55.4%) were ≤ 5 years of age. There were 357 boys, giving a ratio of boys to girls of almost 2:1. The gender ratios were similar for preschool (≤ 5 years) and school-aged children as 192/314 (61.1%) of the former and 165/253 (65.2%) of the latter were boys. The mean (\pm SD) age of all children was 5.3 ± 3.6 years with a range of 1 month to 19 years.

In addition to chronic rhinitis, a history of asthma was recorded in 414 patients (73.0%), of eczema in 221 (39.0%), and of conjunctivitis in 44 (7.7%), and a family history of atopy in 414 (73.0%). The prevalence of asthma was similar in the two age groups, as 237 (75.5%) preschool children and 177 (70%) school-aged children were diagnosed asthmatics.

The frequency of the nasal symptoms of a blocked and/or runny nose are shown in Fig. 1. In the two age groups the presence of both symptoms was reported with similar frequency, occurring in 190/314 (60.5%) preschool children and 149/253 (58.9%) school-aged children. A runny nose alone was reported more commonly in the younger age group, affecting 24.5% of the preschool children and 10.3% of school-aged children ($P < 0.001$) while prevalences were reversed in respect of a blocked nose — 11.1% and 26.5%, respectively ($P < 0.001$). A runny nose was therefore the commonest single symptom affecting preschool children (85.0%) whereas a blocked nose occurred most frequently in the older school-going children (85.3%). The other two symptoms diagnostic of rhinitis — sneezing and an itchy nose — occurred less frequently in this study population. The respective prevalences for the study population as a whole and the younger and older children were: 289/567 (51.0%), 147/314 (46.8%) and 142/253 (56.1%) for sneezing, and 171/567 (30.2%), 86/314 (27.4%) and 85/253 (33.6%) for an itchy nose (Table I).

The prevalences of other symptoms and signs of chronic rhinitis are shown in Table II, and the prevalences of problems associated with rhinitis are shown in Table III. The appearance of the nasal mucosa was useful in diagnosis in terms of boggy and wetness of the turbinates but not colour. The classic textbook description of pale or pale grey mucosa (especially for allergic rhinitis) was not found in most patients and this description has now been dropped from much of the literature. Statistical analysis of the combination of factors in each of the three groups revealed that both primary symptoms (Table IV) and certain associated problems differed in the preschool and school-going groups ($P < 0.0005$ and $P < 0.001$, respectively, for primary and associated symptoms). No statistically significant difference was detected for associated signs ($P > 0.50$); in respect of related problems a significant difference was once again detected ($P < 0.001$) (Table V).

Discussion

This study describes the presenting symptoms of chronic rhinitis in children, emphasising the relative frequencies of individual symptoms that constitute the symptom complex of chronic (non-infectious) rhinitis. Although the association of most of these symptoms with chronic rhinitis is well described and well recognised,¹²⁻¹⁴ this paper describes the frequencies with which they occur, thereby highlighting their importance to the clinician in identifying chronic rhinitis. Furthermore, the South African climate is sufficiently warm much of the year to produce a longer-lasting pollen season than colder northern climates.^{16,17} Symptoms are therefore more chronic where associated with allergic rhinitis and, if not treated, possibly more likely to result in the complications of chronic rhinitis. This paper also describes the prevalences of complications and surgical interventions for these complications.

The onset of allergic rhinitis is classically described at between 5 and 10 years of age, with a peak occurring between 10 and 20 years.^{14,18,19} Chronic rhinitis is frequently due to atopy and therefore also peaks in this age group; however, rhinitis may occur at any age. Our survey was

Table I. Primary symptoms of allergic rhinitis

Primary symptom	Age group			P-value†
	All children (N = 567)	Preschool children (N = 314)	School-aged children (N = 253)	
Runny nose only	103 (18.2%)	77 (24.5%)	26 (10.3%)	< 0.001*
Blocked nose only	102 (18.0%)	35 (11.1%)	67 (26.5%)	< 0.001*
Both symptoms	339 (59.8%)	190 (60.5%)	149 (58.9%)	0.348
Sneezing	289 (51.0%)	147 (46.8%)	142 (56.1%)	0.014*
Itching	171 (30.2%)	86 (27.4%)	85 (33.6%)	0.055

* Statistically significant at the 5% significance level.
† Z-test.

Table II. Prevalences of associated symptoms and signs of allergic rhinitis

Symptom	Age group			P-value†
	All children (N = 567)	Preschool children (N = 314)	School-aged children (N = 253)	
Associated symptoms				
Recurrent epistaxis	107 (18.87%)	32 (10.19%)	75 (29.64%)	< 0.001*
Snoring	331 (58.38%)	187 (59.55%)	144 (56.92%)	0.263
Restless sleeper	359 (63.32%)	209 (66.56%)	150 (59.29%)	0.037
Daytime tiredness	262 (46.21%)	130 (41.40%)	132 (52.17%)	0.005*
Irritable	211 (37.21%)	120 (38.22%)	91 (35.97%)	0.291
Post-nasal drip	402 (70.90%)	201 (64.01%)	201 (79.45%)	< 0.001*
Stomach ache	221 (38.98%)	98 (31.21%)	123 (48.62%)	< 0.001*
Sore throats	264 (46.56%)	119 (37.90%)	145 (57.31%)	< 0.001*
Halitosis	219 (38.62%)	99 (31.53%)	120 (47.43%)	< 0.001*
Frequent colds	347 (61.20%)	212 (67.52%)	135 (53.36%)	< 0.001*
Associated signs				
Allergic shiners	349 (61.55%)	159 (50.64%)	190 (75.10%)	< 0.001*
Allergic salute	380 (67.02%)	187 (59.55%)	193 (76.28%)	< 0.001*
Mouth breathing	323 (56.97%)	154 (49.04%)	169 (66.80%)	< 0.001*

* Statistically significant at the 5% significance level.
† Z-test.

Table III. Prevalence of problems related to allergic rhinitis

Symptom	Age group			P-value†
	All children (N = 567)	Preschool children (N = 314)	School-aged children (N = 253)	
Learning problems	61 (10.76%)	-	61 (24.11%)	
Ear problems	266 (46.91%)	161 (51.27%)	105 (41.50%)	0.010*
Grommets	175 (22.05%)	44 (14.01%)	81 (32.02%)	< 0.001*
Recurrent tonsillitis	210 (37.04%)	101 (32.17%)	109 (43.08%)	0.004*
Tonsillectomy	129 (22.75%)	48 (15.29%)	81 (32.02%)	< 0.001*
Adenoidectomy	107 (18.87%)	37 (11.78%)	70 (27.67%)	< 0.001*
Sinus headaches	121 (21.34%)	32 (10.19%)	89 (35.18%)	< 0.001*
Sinus washout	39 (6.88%)	17 (5.41%)	22 (8.70%)	0.062

* Statistically significant at the 5% significance level.
† Z-test.

Table IV. Statistical comparison of primary symptoms for grouped data

Primary symptom	Preschool children (observed, expected, chi-square)			School-aged children (observed, expected, chi-square)			All
	Observed	Expected	Chi-square	Observed	Expected	Chi-square	
Runny nose only	77	54.9	8.9	26	48.1	10.2	103
Blocked nose only	35	54.4	6.9	67	47.6	7.9	102
Both symptoms	190	180.6	0.5	149	158.4	0.6	339
Sneezing	147	154.0	0.3	142	135.0	0.4	289
Itching	86	91.1	0.3	85	79.9	0.3	171
Total	535	535	16.89	469	469	19.26	1 004

Chi-square = 36.16 Critical value = 9.488 P-value < 0.0005

Table V. Statistical comparison of symptom complexes for grouped data

Symptom	Preschool children (observed, expected, chi-square)			School-aged children (observed, expected, chi-square)			All
Associated symptoms							
Recurrent epistaxis	32	55.3	9.8	75	51.7	10.5	107
Snoring	187	171.0	1.5	144	160.0	1.6	331
Restless sleeper	209	185.5	3.0	150	173.5	3.2	359
Daytime tiredness	130	135.4	0.2	132	126.6	0.2	262
Irritable	120	109.0	1.1	91	102.0	1.2	211
Post-nasal drip	201	207.7	0.2	201	194.3	0.2	402
Stomach ache	98	114.2	2.3	123	106.8	2.5	221
Sore throats	119	136.4	2.2	145	127.6	2.4	264
Halitosis	99	113.2	1.8	120	105.8	1.9	219
Frequent colds	212	179.3	6.0	135	167.7	6.4	347
Total	1 407	1 407	28.1	1 316	1 316	30.0	2 723
	Chi-square = 58.08		Critical value = 16.919		P-value < 0.0005		
Associated signs							
Allergic shiners	159	165.9	0.3	190	183.1	0.3	349
Allergic salute	187	180.6	0.2	193	199.4	0.2	380
Mouth breathing	154	153.5	0.0	169	169.5	0.0	323
Total	500	500	0.51	552	552	0.46	1 052
	Chi-square = 0.98		Critical value = 5.991		P-value > 0.50		
Related problems							
Learning problems	0	25.4	25.4	61	35.6	18.1	61
Ear problems	161	110.6	22.9	105	155.4	16.3	266
Grommets	44	52.0	1.2	81	73.0	0.9	125
Recurrent tonsillitis	101	87.3	2.1	109	122.7	1.5	210
Tonsillectomy	48	53.6	0.6	81	75.4	0.4	129
Adenoidectomy	37	44.5	1.3	70	62.5	0.9	107
Sinus headaches	32	50.3	6.7	89	70.7	4.7	121
Sinus washout	17	16.2	0.0	22	22.8	0.0	39
Total	440	439.9	60.2	618	618.1	42.89	1 058
	Chi-square = 103.13		Critical value = 12.592		P-value < 0.001		

conducted in a paediatric practice and teenagers are therefore likely to be under-represented, with a consequent underestimation of the numbers of older children and adolescents presenting with chronic rhinitis. However, we did observe an almost equal distribution between children younger and older than 5 years; in fact, in contrast to these observations, there was a slightly higher presentation rate in preschool children. Chronic (including allergic) rhinitis has been observed in the newborn period,²⁰ and this, rather than eczema, was reported by Orgel *et al.*²¹ to be the earliest manifestation of allergy. Doctors need to be aware of this early age of onset and the possibility of making the diagnosis of chronic rhinitis in very young children. The high rate of frequent or persistent 'colds', particularly in preschool children, can be seen as a failure to recognise chronic (non-infectious) rhinitis.

Mygind *et al.*¹⁵ divided patients presenting with chronic rhinitis into 'runners' and 'blockers' and noted that patients with seasonal allergic rhinitis are more commonly 'runners' while those with perennial non-allergic rhinitis were more commonly 'blockers'. These symptoms reflect the pathogenesis of rhinitis. Rhinorrhoea is the result of glandular activity and leakage of plasma while nasal

blockage results from a decrease in the tone of the capacitance vessels and tissue oedema.¹³ The latter is thought to reflect more chronic changes in the nasal mucosa. We have shown that these two symptoms occurred with equal frequency, although a runny nose was slightly more common in younger children. As mentioned above, the South African climate results in 'seasonal' allergic symptoms almost year-long. Consequently, patients with allergic rhinitis tend to be prone to the more chronic symptoms, particularly the older children in whom the disease is likely to have been present for a longer period of time. Our observations are therefore not in conflict with those of Mygind *et al.*¹⁵ but reflect rather the unique clinical presentation of allergic rhinitis as a result of our climate.

Nasal congestion with obstruction is the major mechanism for the development of complications associated with chronic rhinitis. As discussed above, because obstruction is more chronic in South Africa, chronic rhinitis would be expected to be associated with high prevalences of these complications. Recurrent middle ear infections were reported in just under half of our patients, a higher prevalence than described in previous reports.^{22,23} The higher prevalence in younger children is in keeping with previous

observations. Previous use of grommets was also reported frequently. Nearly 1 in 5 patients reported sinus headaches, although among the older children these were reported to occur in more than one-third. The lower prevalence in preschool children possibly reflects the inability to vocalise such a symptom at this age, and the fact that many of the sinuses are not yet fully aerated and are therefore not prone to congestion. A recent study in children attending an allergy clinic with rhinitis showed computed tomographic evidence of sinusitis in 63%.²⁴

Increased upper airway resistance from nasal congestion is recognised as the mechanism that produces sleep disturbances associated with allergic rhinitis. Patients experience obstructive sleep apnoea and significantly more micro-arousals.^{25,26} This disturbed or restless poor-quality sleep produces chronic fatigue which, in children, manifests in daytime tiredness and irritability and learning problems at school.²⁷ This study showed that nearly two-thirds of children snored at night, reflecting upper airway obstruction; many of these children continued to snore despite having had their adenoids and tonsils removed. Daytime tiredness and irritability were also frequently reported, but by far the most worrying aspect of this component of the disease syndrome was the high prevalence of reported perceived learning difficulties at school. Nearly 1 in 4 of the school-aged children had had some form of learning problem.

Nasal congestion is responsible for the typical 'allergic' or adenoidal facies and mannerisms associated with chronic rhinitis. The infra-orbital dark circles or bags ('allergic shiners') are probably related to venous plexus engorgement. The venous plexus of the mid-face drains into the nose. The 'allergic gape' or continuous open-mouth breathing is a result of nasal blockage as is the 'allergic salute', which is a frequent upward rubbing of the nose in an attempt to relieve the obstruction.^{14,15} These features were frequently reported among our patients. Therefore, patients with chronic rhinitis can often be recognised by their typical facial characteristics. These may not be specific to allergic rhinitis.

Other symptoms associated with chronic rhinitis which were reported frequently are post-nasal drip and its associated sore throats, stomach aches and halitosis. The irritation of the mucosa by the post-nasal drip is responsible for the sore throats and stomach aches, and its presence in the throat produces halitosis.¹³

Conclusion

In this survey of symptoms, clinical manifestations and complications of chronic non-infectious rhinitis in children we have described the frequency with which these occur. The study highlights the chronic nature of symptoms, including those of allergic rhinitis, because of the warm South African climate with its almost year-long pollen season. As symptoms tend to be chronic, with nasal congestion the main manifestation of this chronicity, complications are most commonly associated with nasal congestion and therefore high prevalences of complications were noted. Of special concern is the high frequency with which learning problems were associated with allergic rhinitis. If 1 in 5 children has chronic rhinitis and 1 in 4 of

these has learning problems secondary to his or her rhinitis, then 1 in 20 children — more than 1 per class — will be struggling at school because of a blocked nose. Doctors therefore need to be aware of the magnitude of the problem and to be familiar with the manifestations of chronic rhinitis to ensure that children are appropriately and timeously treated to avoid complications. This study is the first to describe a difference in both the presentation and complications of chronic rhinitis through its categorisation of preschool and school-aged children.

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REFERENCES

1. Kaliner MA. Allergic rhinitis. In: Mygind N, Naclerio RM, eds. *Allergic and Non-Allergic Rhinitis. Clinical Aspects*. Copenhagen: Munksgaard, 1993.
2. Dotterud LK, Kvammen B, Bolle R, Falk ES. A survey of atopic diseases among school children in Sor-Varanger community. Possible effects of subarctic climate and industrial pollution. *Acta Derm Venereol* 1994; **74**: 124-128.
3. Charpin D, Hughes B, Mallea M, Sutra JP, Balansard G, Vervloet D. Seasonal allergic symptoms and their relation to pollen exposure in south-east France. *Clin Exp Allergy* 1993; **23**: 435-439.
4. Druce H, Kaliner MA. Allergic rhinitis. *JAMA* 1989; **259**: 260-263.
5. Viner AS, Jackman N. Retrospective survey of 1 271 patients diagnosed as perennial rhinitis. *Clin Allergy* 1976; **6**: 251-259.
6. Weinberg EG. Allergic rhinitis. In: Potter PC, ed. *The ALLSA Handbook of Practical Allergy*. Cape Town: Credo Press, 1994.
7. Aberg N. Asthma and allergic rhinitis in Swedish conscripts. *Clin Exp Allergy* 1989; **19**: 59-63.
8. Fleming DM, Crombie DL. Prevalence of asthma and hay fever in England and Wales. *BMJ* 1987; **294**: 279-283.
9. Barbee RA, Kaltenborn N, Lebowitz MD, Burrows B. Longitudinal changes in allergic skin test reactivity in a community population sample. *J Allergy Clin Immunol* 1987; **79**: 16-24.
10. International Rhinitis Management Working Group. International consensus report on the diagnosis and management of rhinitis. *Allergy* 1994; **49**: S1-S34.
11. Sibbald B. Epidemiology of allergic rhinitis. In: Burr ML, ed. *Epidemiology of Clinical Allergy. Monographs in Allergy*. Basel: Karger, 1993.
12. Warner JO. Nasal allergy in children. In: Mackay IS, ed. *Rhinitis. Mechanisms and Management*. London: Trinity Press, 1989.
13. Pipkorn U. Allergic rhinitis — diagnosis and treatment. In: Holgate ST, Church MK, eds. *Allergy*. London: Gower Medical Publishing, 1993.
14. Siegel SH. Rhinitis in children. In: Mygind N, Naclerio RM, eds. *Allergic and Non-Allergic Rhinitis. Clinical Aspects*. Copenhagen: Munksgaard, 1993.
15. Mygind N, Pedersen M, Nielsen MH. Morphology of the upper airway epithelium. In: Proctor DF, Andersen I, eds. *The Nose: Upper Airway Physiology and the Atmospheric Environment*. Amsterdam: Elsevier, 1982.
16. Potter PC, Buys C. Investigating the allergic patient. In: Potter PC, ed. *The ALLSA Handbook of Practical Allergy*. Cape Town: Credo, 1994.
17. Bousquet J, Michel F-B. Immunotherapy. In: Mygind N, Naclerio RM, eds. *Allergic and Non-Allergic Rhinitis. Clinical Aspects*. Copenhagen: Munksgaard, 1993.
18. Haahela R, Heiskala M, Suonemi I. Allergic disorders and immediate skin test reactivity in Finnish adolescents. *Allergy* 1980; **35**: 433-441.
19. Hagy GW, Settapani GA. Bronchial asthma, allergic rhinitis and allergy skin tests among college students. *J Allergy* 1969; **44**: 323-326.
20. Ingall M, Glaser J, Meltzer RS, Dreyfuss EM. Allergic rhinitis in early infancy. *Pediatrics* 1995; **35**: 108-110.
21. Orgel H, Kemp J, Meltzer E. Atopy and IgE in paediatric practice. *Ann Allergy* 1977; **39**: 161-164.
22. Bernstein JM, Ellis E, Li P. The role of IgE-mediated hypersensitivity in otitis media with effusion. *Otolaryngol Head Neck Surg* 1981; **89**: 874-878.
23. Scadding GK, Alles R, Hawk L, Darby Y, Navas-Romero J, Martin JAM. Medical management of serous otitis media. *Clin Exp Allergy* 1993; **23**: suppl. 14.
24. Nguyen K-L, Corbett NL, Garcia DP, et al. Chronic sinusitis among paediatric patients with chronic respiratory complaints. *J Allergy Clin Immunol* 1993; **6**: 824-830.
25. McNicholas WT, Tarlo S, Cole P, et al. Obstructive sleep apnoea in patients with seasonal allergic rhinitis. *Am Rev Respir Dis* 1982; **126**: 625-628.
26. Lavie P, Gertner R, Zomer J, Podoslim L. Breathing disorders in sleep associated with microarousals in patients with allergic rhinitis. *Acta Otolaryngol* 1981; **92**: 529-533.
27. Vuurman EFPM, van Veggel LMA, Uiterwijk MMC, Leutner D, O'Hanlon JF. Seasonal allergic rhinitis and antihistamine effects on children's learning. *Ann Allergy* 1993; **71**: 121-126.

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