International Journal of Pediatric Otorhinolaryngology (2006) 70, 501—505

International Journal of Pediatric Otorhinolaryngology

www.elsevier.com/locate/ijporl

Subjective and objective nasal obstruction assessment in children with chronic rhinitis

Kostas N. Priftis [a,*], Kostas Drigopoulos [b], Afrodite Sakalidou [a], Maria Triga [a], Vasilis Kallis [b], Polyxeni Nicolaidou [c]

[a] *Department of Allergology-Pulmonology, Penteli Children's Hospital, P. Penteli 152 36, Greece*
[b] *Department of Otorhinolaryngology/Head and Neck Surgery, Penteli Children's Hospital, P. Penteli 152 36, Greece*
[c] *Third Department of Pediatrics, Attikon Hospital, University of Athens School of Medicine, Athens, Greece*

Received 14 March 2005; accepted 30 July 2005

KEYWORDS
Chronic rhinitis;
Nasal blockage;
Rhinomanometry;
Self-assessment;
Decongestion test

Summary

Objective: The present study was undertaken, to test the hypothesis that schoolchildren on long-term treatment for chronic rhinitis under-report their nasal congestion.
Methods: Ninety-seven children aged 8.3—15.5 years (median 12.7) with non-purulent perennial rhinitis, for 1.4—8.5 years (median 2.8) self-graded their nasal blockage as "severe" (group-A), "moderate" (group-B), "mild" (group-C) or "absent" (group-D). An additional 48 normal children served as controls (group-E). Subsequently active anterior rhinomanometry for total nasal airway resistance (TNAR) measurement and decongestion test (>20% TNAR fall) were employed as objective means of nasal congestion.
Results: Mean pre-decongestion TNAR values did not show any significant difference between the group-A, -B and -C; significant differences were observed between group-A and -D ($p = 0.04$) and between all groups as compared to -E. Positive decongestion test was detected in 57.1%, 53.8%, 48.3%, 32.3% and 10.4% of children in group-A, -B, -C, -D and -E, respectively (group-A, -B, -C versus -E $p < 0.001$, group-D versus -E $p = 0.03$).
Conclusions: Schoolchildren on long-term treatment for perennial rhinitis frequently under-report their symptom of nasal stuffiness.

* Corresponding author. Tel.: +30 210 8036484; fax: +30 210 6131173.
E-mail address: kpriftis@otenet.gr (K.N. Priftis).

0165-5876/$ — see front matter © 2005 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.ijporl.2005.07.027

1. Introduction

Nasal congestion is one of the most prominent symptoms of chronic rhinitis. In clinical practice, determination of the degree of nasal obstruction is mainly based upon the patient's — adult or child — subjective self assessment [1,2].

The prevalence of physician-diagnosed allergic rhinitis in school-children has been reported to be up to 40% [3]. However, assessment of symptoms' severity, patient's discomfort and treatment effectiveness have also been based upon the children's subjective description. The accuracy and the reliability of such descriptions are questionable.

Over the past 20 years, a number of reports have looked at the relationship between subjective assessment and objective measurement of nasal airway obstruction [4—11]. Most of the studies dealt with adults, focusing on subjects with seasonal allergic rhinitis and even more, after nasal provocation test. Nevertheless, a more marked sensation of nasal congestion would be expected under such conditions, as the change of nasal patency occurs acutely. Consequently, subjective grading of nasal blockage by patients on long-term treatment for persistent rhinitis may well be fundamentally different.

Nasal airflow and resistance measurements represent an objective and quantitative assessment of nasal patency, and active anterior rhinomanometry, is the most reliable and frequently used method to assess these parameters [12,13].

The present study was undertaken, to test the hypothesis that schoolchildren on long-term treatment for chronic rhinitis under-report their nasal congestion.

2. Materials and methods

Children 8—15 years of age with diagnosed non-purulent perennial rhinitis followed at the outpatient clinic of Allergology-Pulmonology Department (KP, AS, MT) were enrolled in the study. All subjects were on long-term treatment with nasal topical corticosteroids continuously for a minimum of four months prior to enrollment. Patients with nasal skeletal deformity, nasal polyps, adenoid hyperplasia, and acute upper respiratory infection within two weeks from enrolment were excluded from the study. All nasal medication was discontinued for 24 h prior to the study visit.

During a routine follow-up visit at the outpatients' Allergy Clinic, after a rest period of 30 min, a simple structured questionnaire was administered in order to estimate the children's subjective nasal blockage assessment. They were asked to blow their nose and then grade their nasal blockage at the level of: "severe" (group-A), "moderate" (group-B), "mild" (group-C) or "absent" (group-D). Objective measurements followed.

Active anterior rhinomanometry with mask was performed via a computerized rhinomanometric system (Rhinomanometer PC 200). A minimum of three to five breaths were recorded at a fixed transnasal pressure of 150 Pa during quiet breathing with the mouth closed in the sitting position. The airflow resistance of both nasal cavities was measured and the total nasal airway resistance (TNAR) was calculated (total value for right and left nostrils). Values were expressed as a ratio between transnasal pressure and flow ($Pa/cm^3/s$). Eight minutes after topical application of two puffs of xylometazoline 0.1% nasal spray in each nostril, another measurement was made. The conventional criterion of $>20\%$ fall of TNAR was adopted as a positive decongestion test [14].

Atopic status was estimated by skin prick testing to 20 common environmental inhaled allergens.

Children with no history of chronic nasal or other respiratory symptoms, matched for age, sex and height served as controls (group-E).

Parents of each subject and older children gave written informed consent. The study was approved by the Ethics Committee of the Hospital.

Statistical analysis was performed using the one-way ANOVA-analysis for quantitative variance and Spearman correlation for qualitative data. Chi-square test was also used to compare dependent variance. The statistical analysis was done using the SPSS 11.5.

3. Results

Ninety-seven children (51 males) with diagnosis of non-purulent perennial rhinitis were enrolled in the study. Their age ($\pm$S.D.) was 12.3 ± 1.9 years and their height 149.1 ± 12.8 cm. The duration of a past history of rhinitis ranged from 1.4 to 8.5 years (median 2.8 years). The demographic characteristics of patients and controls are shown in Table 1. There was a Gausian distribution of ages and heights in all five groups and there were no significant differences in age or height among groups.

All patient values of the TNAR for each group before and after decongestion are illustrated in Fig. 1. A significant correlation was detected between baseline TNAR values and the subjective nasal congestion grading of the patients with

Table 1 Demographic characteristics of the studied children (group-A, -B, -C, -D and -E)

	Group-A (N = 14)	Group-B (N = 23)	Group-C (N = 29)	Group-D (N = 31)	Group-E (N = 48)
Age (years) (median, range)	(12.5) (8.3–14.4)	(12.7) (8.3–15.5)	(12.3) (8.6–15.1)	(13.1) (9.0–14.8)	(12.3) (8.7–15.2)
(mean ± S.D.)	(11.9 ± 2.0)	(12.2 ± 2.2)	(12.1 ± 1.9)	(12.6 ± 1.8)	(12.3 ± 1.8)
Height (cm) (median, range)	(148.3) (128.2–167.7)	(145.3) (124.8–169.4)	(147.2) (124.5–168.5)	(154.7) (127.8–169.4)	(149.1) (129.3–172.6)
(mean ± S.D.)	(148.6 ± 11.9)	(147.5 ± 13.4)	(149.1 ± 13.1)	(149.1 ± 12.8)	(149.7 ± 11.9)
Gender ratio (M/F)	9/5	13/10	15/16	14/17	25/23
Past history of rhinitis (years) (median, range)	(2.7) (1.8–5.7)	(2.4) (1.8–8.2)	(2.1) (2.0–7.5)	(2.5) (1.4–8.5)	
Coexisting asthma (%)	42.9	52.2	44.8	54.8	
Positive skin prick tests (%)	64.3	60.1	68.9	64.5	
Family history of allergies (%)	57.1	60.1	44.8	61.3	22.9
Treatment duration with nasal topical corticosteroids (years) (median, range)	(1.2) (0.8–4.8)	(1.7) (0.4–6.0)	(2.1) (1.2–4.4)	(1.4) (0.6–6.5)	

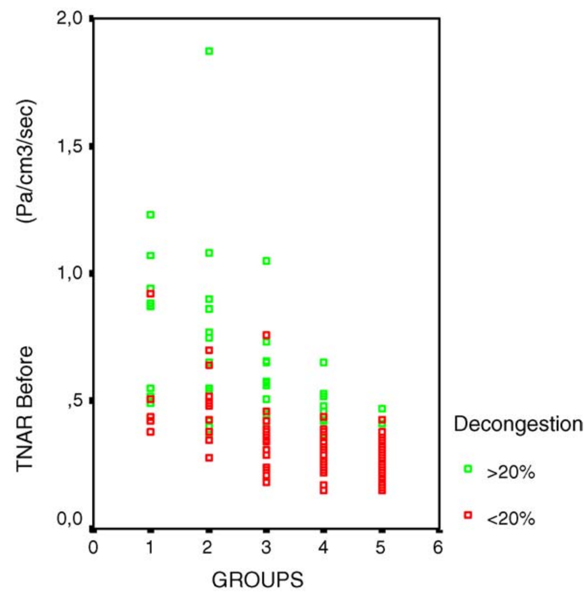

Fig. 1 Scatter plot of the values of total nasal airway resistance (TNAR) at transnasal pressure of 150 Pa before decongestion in the four patient groups of varying subjective nasal congestion and the controls. Cases are also discriminated according to the positiveness of their decongestion test (>20% improvement). The numbers at the horizontal axis correspond with: 1 to group-A, 2 to group-B, 3 to group-C, 4 to group-D, 5 to group-E.

chronic rhinitis studied ($r = 0.495$, $p < 0.001$). However, mean TNAR values before decongestion did not reach any significant difference between the group-A, -B and -C but between the group-A and -D ($p = 0.04$) and between all of the groups compared to -E. A borderline difference was detected between group-B versus -D ($p = 0.06$).

A significant decongestive effect in terms of TNAR reduction was observed in all of the groups. However, a >20% fall of TNAR after decongestion was detected in 57.1% of children in group-A, 53.8% in group-B, 48.3% in group-C, 32.3% in group-D, and 10.4% in the control group. These differences reached significance when the cases with >20% fall of TNAR in group-A, -B and -C were compared to group-E ($p < 0.001$), as well as the cases in group-D to group-E ($p = 0.03$). A correlation between the resistance reduction after decongestion and the pre-decongestion test subjective nasal grading ($r = -0.598$, $p < 0.001$) was also detected.

No significant correlations between the frequency of positive decongestion test response and atopy, coexistence of asthma, atopic family history or duration of treatment within the groups were detected. In addition, no significant correlations were found between the magnitude of TNAR reduction and atopy, coexistence of asthma, atopic family history or duration of treatment within the groups.

4. Discussion

The main finding of the present study is the extensive distribution of various TNAR values over a specific subjective grade — asymptomatic, mild, moderate or severe — of nasal obstruction among schoolchildren followed for perennial rhinitis, indicating the limited sensitivity of subjective assessment despite a correlation between subjective and objective measurements. Indeed, a discrepancy between the subjective and the objective assessment of the degree of nasal blockage was often observed.

Of particular interest is the finding that symptomatic groups — mild, moderate or severe — did not differ from one another regarding their response to the decongestion test; in fact, the only significant differences noted were between each patient group (group-A, -B, -C and -D) and controls (group-E). In addition, although a considerable number of our perennial rhinitis population reported absence of nasal congestion, approximately one third of these children had a positive decongestion test, indicating that an impressive under-reporting of morbidity among these patients may exist.

In the present study, rhinomanometric values were obtained according to the International Committee report on standardization of the rhinomanometry [12]. Recently, Zapletal and Chalupova [15] did not observe gender differences in nasal airflow and resistance values, but only in height and age. Our analysis showed a Gausian distribution of ages and heights in all five groups of the studied population and there were no significant differences in age or height among groups.

The decongestion testing, with the criterion of positivity set at achieving a more than 20% change from the baseline value, has been widely accepted as the conventional method for evaluating reversibility of nasal mucosa blockage [14,16]. The loose relationship between subjective nasal stuffiness and objective nasal patency measurement has been also extensively discussed in the literature [4—11]. However, although the guidelines for diagnosis and management of rhinitis published by Joint Task Force on Practice Parameters in Allergy, Asthma and Immunology, recognize the doubtful reliability of subjective perception of nasal stuffiness, they suggest that rhinomanometry should be reserved for selected cases only [1]. Despite the fact that potential usage of various rhinomanometric techniques has been addressed by the recent publication on Practice Parameters by the same Task Force [2], precise criteria for objective assessment of nasal obstruction have yet to be determined.

Regarding the clinical evaluation of symptom severity, the above-mentioned recent guidelines suggest the use of a 7-point visual analog scale [4]. However, as Watson et al. [11] have already commented, fewer options in subjective scoring may potentially increase the correlation of two measurements.

The degree of subjective sensation of nasal stuffiness seems to be crucially influenced by the chronicity of the symptom. On the one hand, it has been reported that nasal provocation testing is characterized by a good correlation between subjective and objective assessment [9—11,17]. On the other hand, subjective improvement of congestion was not easily detected in children treated with topical steroids for chronic rhinitis [18]. Our results suggest that children with perennial rhinitis tend to under-report nasal stuffiness during regular follow-up. Whether such under-reporting is due to poor sensation of nasal obstruction or an attempt to excuse poor compliance with chronic medication and/or possibly shorten the treatment period is a matter for further investigation. At any event, physicians running "rhinitis clinics" should probably base management decisions on objective measurements during the follow-up of patients on long-term treatment for chronic rhinitis. In this context, it should be born in mind that nasal inspiratory peak flow measurement is considered as a cheap, quick and easy to administer alternative method to rhinomanometry [5].

The detection of 10.4% of normals with positive decongestion test is also of interest. A considerable proportion of children without any recent complaint of nasal blockage improve their TNAR more than 20% after decongestion, indicating that a subclinacal rhinitis could exist.

In conclusion, our findings suggest that — despite the positive correlation of subjective and rhinomanometric measurements — schoolchildren on long-term treatment for perennial rhinitis frequently under-report their symptom of nasal stuffiness. Therefore, an objective method to assess severity of their nasal obstruction may essentially contribute to effective clinical decision-making.

References

[1] M.S. Dykewicz, S. Fineman, D.P. Skoner, R. Nicklas, R. Lee, J. Blessing-Moore, et al. Diagnosis and management of rhinitis: complete guidelines of the Joint Task Force on Practice Parameters in Allergy, Asthma and Immunology. American Academy of Allergy, Asthma, and Immunology, Ann. Allergy Asthma Immunol. 81 (5 Pt 2) (1998) 478—518.

[2] S.L. Spector, R.A. Nicklas, J.A. Chapman, I.L. Bernstein, W.E. Berger, J. Blessing-Moore, et al. Joint Task Force on Practice Parameters; American Academy of Allergy, Asthma, and Immunology; American College of Allergy, Asthma, and

Immunology; Joint Council of Allergy, Asthma, and Immunology. Symptom severity assessment of allergic rhinitis: part 1, Ann. Allergy Asthma Immunol. 91 (2003) 105—114.
[3] A.L. Wright, C.J. Holberg, F.D. Martinez, M. Halonen, W. Morgan, L.M. Taussig, Epidemiology of physician diagnosed allergic rhinitis in childhood, Pediatrics 94 (1994) 895—901.
[4] K. Naito, S. Iwata, P. Cole, D. Humphrey, Nasal patence: subjective and objective, Am. J. Rhinol. 3 (1989) 93—97.
[5] M. Holmstrom, G.K. Scadding, V.J. Lund, Y.C. Darby, Assessment of nasal obstruction. A comparison between rhinomanometry and nasal inspiratory peak flow, Rhinology 28 (1990) 191—196.
[6] R. Roithmann, P. Cole, J. Chapnik, S.M. Barreto, J.P. Szalai, N. Zamel, Acoustic rhinometry, rhinomanometry, and the sensation of nasal patency: a correlative study, J. Otolaryngol. 23 (1994) 454—458.
[7] J. Sipila, J. Suonpaa, P. Silvoniemi, P. Laippala, Correlations between subjective sensation of nasal patency and rhinomanometry in both unilateral and total nasal assessment, ORL J. Otorhinolaryngol. Relat. Spec. 57 (1995) 260—263.
[8] A. Hirschberg, O. Rezek, Correlation between objective and subjective assessments of nasal patency, ORL J. Otorhinolaryngol. Relat. Spec. 60 (1998) 206—211.
[9] M. Simola, H. Malmberg, Sensation of nasal airflow compared with nasal airway resistance in patients with rhinitis, Clin. Otolaryngol. 22 (1997) 260—262.
[10] C. Larsson, E. Millqvist, M. Bende, Relationship between subjective nasal stuffiness and nasal patency measured by acoustic rhinometry, Am. J. Rhinol. 15 (2001) 403—405.
[11] W.T. Watson, J.R. Roberts, A.B. Becker, L.F. Gendreau-Reid, F.E. Simons, Nasal patency in children with allergic rhinitis: correlation of objective and subjective assessments, Ann. Allergy Asthma Immunol. 74 (1995) 237—240.
[12] P.A.R. Clement, Committee report on standardization of rhinometry, Rhinology 22 (1984) 151—155.
[13] V.J. Lund, Objective assessment of nasal obstruction, Otolaryngol. Clin. North Am. 22 (1989) 279—290.
[14] C.J. Johansson, T. Carlson, P. Olsson, M. Bende, Efficacy of a topical nasal decongestant in different formulations: the effect of viscosity, Acta Otolaryngol. 112 (1992) 1032—1037.
[15] A. Zapletal, J. Chalupova, Nasal airflow and resistance measured by active anterior rhinomanometry in healthy children and adolescents, Pediatr. Pulmonol. 33 (2002) 174—180.
[16] B. Mamikoglu, S.M. Houser, J.P. Corey, An interpretation method for objective assessment of nasal congestion with acoustic rhinometry, Laryngoscope 112 (2002) 926—929.
[17] F.R. Fernandes, D. Sole, C. Naspitz, F. Munoz-Lopez, Diagnostic value of nasal provocation testing and rhinomanometry in allergic rhinitis, J. Invest. Allergol. Clin. Immunol. 6 (1996) 184—188.
[18] B. Hynes, P. Cole, V. Forte, P. Corey, C.R. Smith, The evaluation of intranasal topical beclomethasone spray in the treatment of children with non-purulent rhinitis using rhinometric, cytologic and symptomatologic assessment, J. Otolaryngol. 18 (1989) 151—154.