ORIGINAL ARTICLE

Quality of Life in Patients With Persistent Allergic Rhinitis Treated With Montelukast Alone or in Combination With Levocetirizine or Desloratadine

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Abstract

Background: Persistent allergic rhinitis often impairs quality of life.
Objective: We assessed the extent to which treating persistent allergic rhinitis with montelukast, desloratadine, and levocetirizine alone or in combination improved quality of life.
Methods: A 32-week randomized, double-blind, placebo-controlled, crossover study was performed in 2 arms: 20 patients received montelukast 10 mg/d and/or desloratadine 5 mg/d or placebo; 20 patients received montelukast 10 mg/d and/or levocetirizine 5 mg/d or placebo. The treatment periods were separated by 2-week washout periods.
Quality of life was assessed on the day before starting treatment and on the last day of each treatment period using the Rhinoconjunctivitis Quality of Life Questionnaire. Sleep problems were also assessed.
Results: In the desloratadine plus montelukast arm, the mean (SEM) quality of life score before treatment was 3.1 (0.41). After placebo, this score was 2.16 (0.43), after desloratadine it was 1.79 (0.38), after montelukast it was 1.48 (0.37), and after montelukast plus desloratadine it was 1.59 (0.37). In the montelukast plus levocetirizine arm, the mean quality of life score before treatment was 2.58 (0.49). After placebo it was 1.78 (0.46), after levocetirizine it was 1.38 (0.42), after montelukast it was 1.36 (0.37), and after montelukast plus levocetirizine it was 1.26 (0.39).
Conclusions: Placebo, montelukast, desloratadine and levocetirizine significantly improved quality of life. Combining montelukast with either levocetirizine or desloratadine gave additional benefits in comparison to each agent alone and could be considered for patients whose quality of life is impaired by persistent allergic rhinitis.

Key words: Persistent allergic rhinitis. Montelukast. Desloratadine. Levocetirizine. Quality of life.

Resumen

Antecedentes: La rinitis alérgica persistente a menudo perjudica la calidad de vida.
Objetivo: Nuestro objetivo fue evaluar hasta qué punto el tratamiento de la rinitis alérgica persistente con montelukast, desloratadina y levocetirizina bien de forma aislada o combinados entre ellos, mejoraba la calidad de vida.
Métodos: Se realizó un estudio clínico aleatorizado, doble ciego, controlado con placebo con dos grupos cruzados de 32 semanas de duración: se administró montelukast 10 mg/d a 20 pacientes y/o desloratadina 5 mg/d o placebo, mientras otros 20 pacientes recibían montelukast 10 mg/d y/o levocetirizina 5 mg/d o placebo. Las fases de tratamiento se separaron por dos semanas de períodos de reposo farmacológico.
La calidad de vida se evaluó el día antes de iniciar el tratamiento y el ultimo día de cada período de tratamiento, utilizando el Cuestionario de Calidad de Vida de la Rinoconjuntivitis. También se evaluaron los problemas relacionados con el sueño.
Resultados: La puntuación media (ESM) de la calidad de vida antes del tratamiento fue de 3,1 (0,41). Después de la administración del placebo esta puntuación fue de 2,16 (0,43), tras la desloratadina fue de 1,79 (0,38), tras montelukast fue de 1,48 (0,37) y después del montelukast más desloratadina fue de 1,59 (0,37). En el grupo de desloratadina más montelukast, la puntuación media de calidad de vida antes del tratamiento fue de 2,58 (0,49). Tras la administración del placebo fue de 1,78 (0,46), trás la levocetirizina fue de 1,38

(0,42), tras montelukast fue de 1,36 (0,37) y después del montelukast más levocetirizina fue de 1,26 (0,39), en el grupo de montelukast más levocetirizina.
Conclusiones: El placebo, el montelukast, la desloratadina y la levocetirizina mejoraron significativamente la calidad de vida. El tratamiento concomitante con montelukast, con levocetirizina o bien con desloratadina, proporcionó beneficios adicionales en comparación con cada fármaco solo, datos a tener en cuenta en pacientes con rinitis alérgica persistente con una calidad de vida deteriorada.

Palabras clave: Rinitis alérgica persistente. Montelukast. Desloratadina. Levocetirizina. Calidad de vida.

Introduction

Allergic rhinitis is a chronic inflammatory disease of the airways that can diminish a person's quality of life. Nasal obstruction is a crucial symptom in persistent allergic rhinitis and is associated with sleep disturbances and subsequent daytime somnolence and impaired performance at school and work [1]. Second-generation antihistamines have little effect on congestion and can sometimes increase sleepiness. Topical corticosteroids reduce congestion and improve sleep quality, thereby reducing daytime sleepiness, although they have many side effects and cannot be administered intranasally for prolonged periods.

The latest-generation potent antihistamines such as desloratadine and levocetirizine have shown decongestant properties in allergic rhinitis studies [2-5]. Montelukast, a leukotriene receptor antagonist, significantly improves daytime and nighttime symptoms in patients with allergic rhinitis [6], and is now an approved therapy for allergic rhinitis. This study compares the efficacy of montelukast, desloratadine, or levocetirizine in monotherapy and the combination of montelukast with desloratadine or levocetirizine.

Materials and Methods

This prospective, randomized, double-blind, crossover, placebo-controlled, 2-arm study had a 2-week run-in period and 4 treatment periods, each lasting for 6 weeks and separated by 2-week washout periods. We investigated the effect of monotherapy with montelukast, levocetirizine, and desloratadine, or the combination of montelukast with levocetirizine or desloratadine, on quality of life and sleep disturbances.

Patients

From among 350 potential study patients, 40 eligible patients (30 female, 10 male, mean [SEM] age 28.9 [2.7]) were selected on the basis of age (18-65 years), a minimum 2-year history of persistent allergic rhinitis, positive skin prick test to perennial allergens relevant for Central Europe (house dust mite, cat, and dog), and nasal congestion score of at least 2 using a 4-point scale (0 = none, 3 = severe). Enrolled patients could not be pregnant, have asthma, be sensitized to seasonal allergens (grass, trees, and weed pollen) or be current smokers. Other exclusion criteria were upper respiratory tract infection during the 6-week period preceding the study, severe illnesses, septal deviation, nasal polyps, acute or chronic rhinosinusitis, and any other condition that might affect nasal breathing or nocturnal sleep pattern. Xylometazoline 0.1% nasal drops were allowed as a rescue medication. Systemic corticosteroids, allergen-specific immunotherapy, sleep medication, and anti-allergic treatment other than the study medication, were all prohibited.

Study Design

The study was approved by the ethics committee of the Medical University of Lodz, Lodz, Poland, and all participants signed an informed consent form.

The treatment period lasted from September to March and was preceded by the enrollment period from June to September. After the 2-week run-in period, eligible participants were randomly assigned to 1 of the following groups:

A. (n = 20 patients) receiving montelukast (10-mg tablets), or levocetirizine (5-mg tablets), or the combination of montelukast (10 mg) and levocetirizine (5 mg) or placebo.
B. (n = 20 patients) receiving montelukast (10-mg tablets), or desloratadine (5-mg tablets), or the combination of montelukast (10 mg) and desloratadine (5 mg) or placebo.

The medication was administered once a day in the evening. Treatment sequence was randomly assigned.

Before treatment, at the randomization visit, and on the last day of each of the 6-week treatment periods, diary cards were collected, and sleep problems, study medication use, concomitant medication use, adverse events, and quality of life were assessed.

Participants reported to the investigators 2 weeks after the end of the last treatment period for a checkup and to provide information on any adverse events.

Efficacy Endpoints

The primary endpoint was the health-related quality of life (HRQL) and nighttime symptoms score. Secondary endpoints included adverse events, rescue therapy, and sleep medication.

HRQL was assessed using the rhinoconjunctivitis quality of life questionnaire (RQLQ) adapted for the Polish population. This questionnaire contains 28 items in 7 domains (activity, sleep, nose symptoms, eye symptoms, non-nose/eye symptoms, practical problems, and emotional function). Each item was scored from 0 (not troubling) to 6 (extremely troubling) [7,8].

The mean value for each health dimension was calculated and the HRQL was presented as a mean of the 7 dimension scores [9]. Additionally, the nighttime symptom scores were taken from the RQLQ and presented as a mean value of the scores for nighttime awakening, difficulty falling asleep, and nasal congestion on awakening (each scored 0 [no symptoms] to 6 [most severe symptoms]). The results for quality of life were interpreted as minimal (0.5) or moderate (1.0).

Participants recorded their nighttime symptom scores on their diary cards before the treatment period (baseline), and on days 14, 21, 28, 35, and 42 of the treatment period. Results are presented for 6-week treatment periods as a mean value of 3 individual scores, each rated from 0 to 3. The scores were as follows: difficulty falling asleep (0 = not at all, 1 = a little, 2 = moderate, 3 = very); nighttime awakening (0 = not at all, 1 = once, 2 = more than once, 3 = all night); and nasal congestion on awakening (0 = none, 1 = mild, noticeable but not troublesome 2 = moderate, noticeable, and troublesome some of the time, 3 = severe, troublesome most of the time/very troublesome some of the time) [7].

Compliance, adverse events, rescue medication, and sleep medication were analyzed using the patients' diary cards.

Spirometry was performed at the randomization visit using a spirometer (Lung Test 1000, Mes Dymek, Dabrowski SA, Kracow, Poland) according to guidelines [10]. The reference values of the European Community for Coal and Steel were used [10]. Values were expressed as a percentage of the predicted values.

Skin prick tests with common aeroallergens (Allergopharma, Katowice, Poland) were performed for each patient 1 day before the study.

Statistical Methods

Statistical analysis was performed using the Kruskal-Wallis ANOVA test, the Mann-Whitney U test, and the Wilcoxon test. A *P* greater than .05 was considered statistically significant. Values are shown with the SEM. Statistica 5.1 PL for Windows (StatSoft Polska, Cracow, Poland) was used for the analyses.

Table 1. Patient Characteristics at Baseline[a]

	A. Montelukast/ Levocetirizine Arm	B. Montelukast /Desloratadine Arm	Mean for A+B
n	20	20	40
Sex	14:6	16:4	30:4
Ethnic origin	Caucasian (100%)	Caucasian (100%)	Caucasian (100%)
Mean age, y	23.65 (2.1)	34.1 (2.69)[b]	28.9 (11.9)
Duration of persistent allergic rhinitis, y	5.65 (0.85)	7.85 (1.32)[b]	6.75 (5.04)

[a] Values are presented with the SEM
[b] $P < .001$ vs montelukast/levocetirizine arm

Results

All the patients completed the double-blind, crossover treatment periods. Only 2 patients were lost to follow-up.

The participants had moderate-to-severe persistent allergic rhinitis with a negative impact on daily activity and sleep. The mean duration of allergic rhinitis was 5.65 (0.85) years for group A and 7.85 (1.32) years for group B. All patients had been diagnosed with sensitization to perennial aeroallergens. Forty participants were sensitized to house dust mites and 6 patients were also sensitized to cat and dog allergens. None were asthmatic or sensitized to seasonal aeroallergens (Table 1).

Primary Efficacy Outcomes

HRQL

Before the study, the quality of life score was 2.58 (0.49) for group A and 3.1 (0.41) for group B on the 0-6 point scale. At the end of the study, placebo and monotherapy with montelukast, desloratadine, or levocetirizine, and combination therapy with montelukast and either desloratadine or levocetirizine significantly improved all the RQLQ domains in both groups. Despite a strong placebo effect, the improvement in HRQL was significantly greater than placebo in participants treated with montelukast alone, levocetirizine alone, or the combination of montelukast with levocetirizine in group A, as well as montelukast alone, desloratadine alone, or the combination of montelukast with desloratadine in group B (Table 2, Figure 1)

There was no significant difference in efficacy with

Table 2. HRQL Score and Nighttime Symptoms Scores[a]

Scores	Treatment	A. Montelukast/ Levocetirizine Arm	B. Montelukast/ Desloratadine Arm
HRQL score	Baseline	2.58 (0.49)	3.10 (0.41)
	Placebo	1.78 (0.46)	2.16 (0.43)
	Antihistamine	1.38 (0.42)	1.79 (0.38)
	Montelukast	1.36 (0.37)	1.48 (0.37)
	Montelukast + antihistamine	1.26 (0.39)	1.59 (0.37)
Nighttime symptoms score (from RQLQ)	Baseline	2.55 (0.93)	2.80 (0.68)
	Placebo	1.55 (0.90)	1.72 (0.76)
	Antihistamine	1.23 (0.80)	1.38 (0.63)
	Montelukast	1.15 (0.72)	1.28 (0.75)
	Montelukast + antihistamine	1.0 (0.72)	1.30 (0.60)
Nighttime symptoms score	Baseline	1.36 (0.25)	1.42 (0.30)
	Placebo	0.90 (0.21)	0.87 (0.20)
	Antihistamine	0.60 (0.21)	0.67 (0.22)
	Montelukast	0.46 (0.23)	0.73 (0.20)
	Montelukast + antihistamine	0.54 (0.22)	0.79 (0.28)

Abbreviations: HRQL, health-related quality of life; RQLQ, rhinoconjunctivitis quality of life questionnaire.
[a] Group A: montelukast alone, levocetirizine alone, or the combination of montelukast and levocetirizine (n = 20). Group B: montelukast alone, desloratadine alone, or the combination of montelukast and desloratadine (n = 20). Values are presented with the SEM.

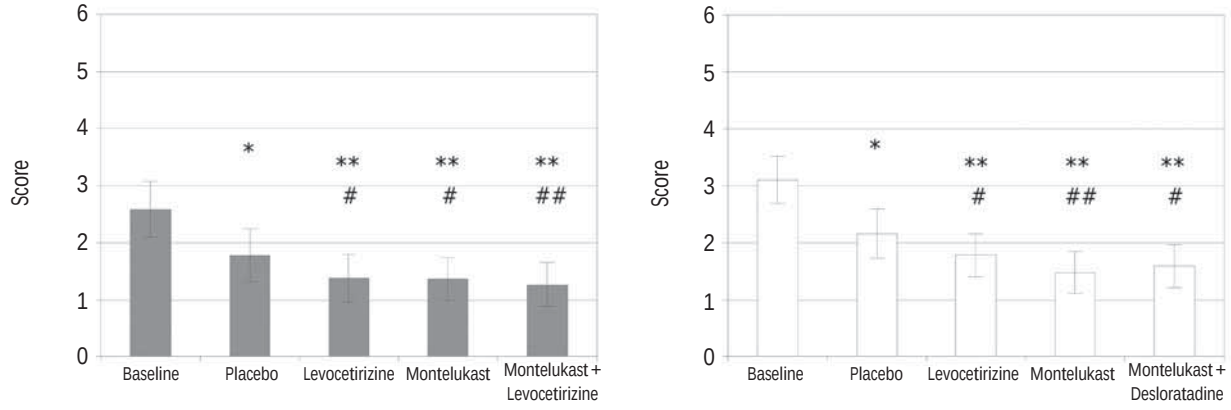

Figure 1. Quality of life in patients treated for 6 weeks with montelukast alone, levocetirizine alone, or the combination of both agents (graph A); montelukast alone, desloratadine alone, or the combination of both agents (graph B), (n = 20). Data are expressed as the mean (SEM). The *P* values were as follows:
Graph A (montelukast/levocetirizine) * $P < .01$ vs baseline, ** $P < .001$ vs baseline, # $P < .05$ vs placebo, ## $P < .01$ vs placebo
Graph B (montelukast/desloratadine) * $P < .01$ vs baseline, ** $P < .001$ vs baseline, # $P < .05$ vs placebo, ## $P < .01$ vs placebo.

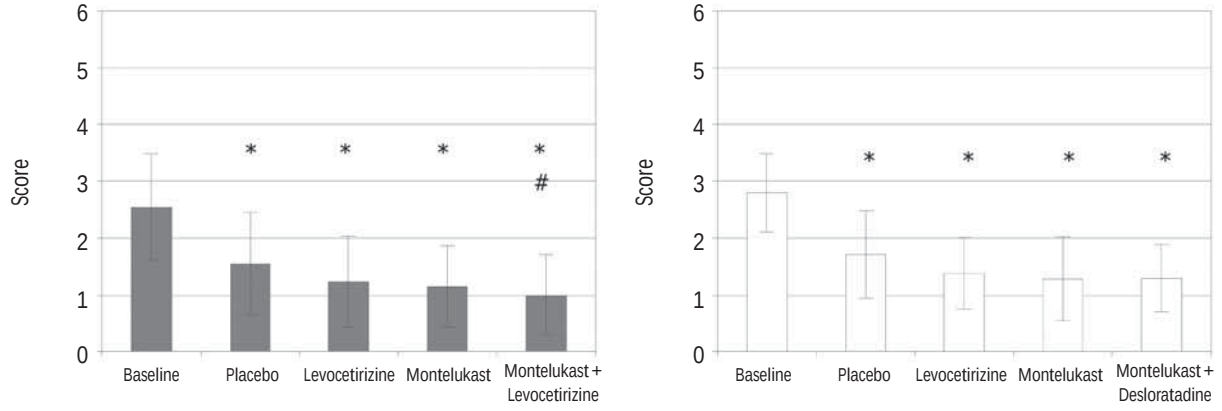

Figure 2. Nighttime symptoms scores in patients treated for 6 weeks with montelukast alone, levocetirizine alone, or with the combination (graph A), montelukast alone or desloratadine alone or with the combination (graph B) (n = 20). Data are expressed as the mean (SEM); *P* values:
Graph A (montelukast/levocetirizine) * $P < .001$ vs baseline, # $P < .05$ vs placebo
Graph B (montelukast/desloratadine) * $P < .001$ vs baseline,

montelukast alone, levocetirizine alone, or montelukast and levocetirizine in group A. Similarly, there was no significant difference in efficacy with montelukast alone, desloratadine alone, or montelukast and desloratadine in group B (Table 2, Figure 1).

Nighttime Symptoms Score

The nighttime symptom score, taken from the RQLQ, presented as a mean value for nighttime awakening, difficulty falling asleep, and nasal congestion on awakening, was troublesome most of the time before the study in both Group A and Group B (Table 1, Figure 2). A significant improvement over baseline was observed in patients treated with placebo, montelukast alone, levocetirizine alone, or the combination of montelukast with levocetirizine in group A, as well as in patients treated with placebo, montelukast alone, desloratadine alone, or the combination of montelukast with desloratadine in group B.

When compared with placebo, only the combination of montelukast and levocetirizine in group A had a significant benefit.

There were no significant differences between monotherapy with montelukast, either antihistamine (levocetirizine in group A, desloratadine in group B), and combination therapy

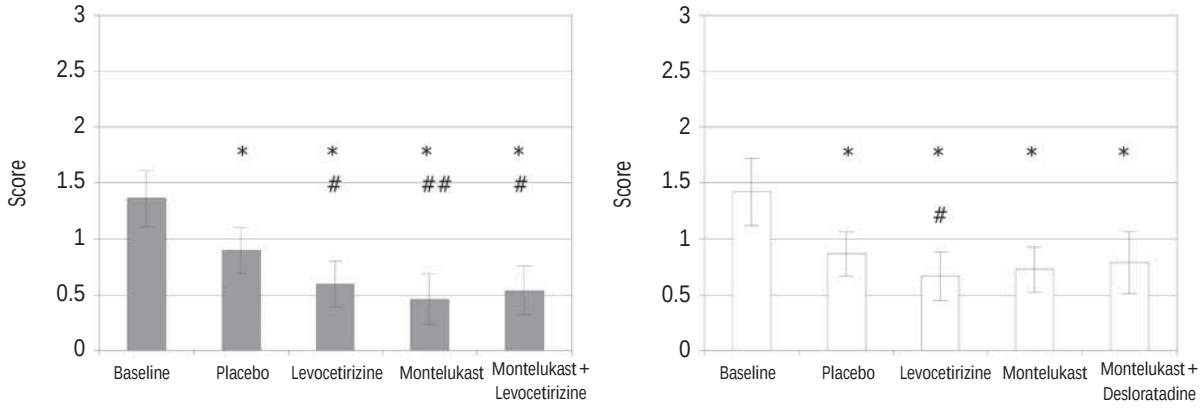

Figure 3. Nighttime symptoms scores based on the diary cards of patients treated for 6 weeks with montelukast alone, levocetirizine alone, or the combination of both agents (graph A), montelukast alone or desloratadine alone or with the combination of both agents (graph B) (n = 20). Data are expressed as the mean (SEM); *P* values:
Graph A (montelukast/levocetirizine) * $P < .001$ vs baseline, # $P < .01$ vs placebo, ## $P < .001$ vs placebo
Graph B (montelukast/desloratadine) * $P < .001$ vs baseline, # $P < .05$ vs placebo

(montelukast with antihistamine) in both groups (Table 2, Figure 2)

Nighttime Symptoms Scores (Diary Cards)

The sleep impairment evaluation, assessed with a 0-3 point scale during the 6-week treatment periods, revealed that placebo, montelukast alone, antihistamine alone (levocetirizine or deloratadine), and the combination of montelukast and an antihistamine significantly improved nighttime symptom scores in comparison with baseline in both groups A and B (Table 2, Figure 3).

In group A, although montelukast alone, levocetirizine alone, and the combination of montelukast and levocetirizine were significantly more effective than placebo, there were no differences between montelukast, levocetirizine, and the combination of these agents. (Table 2, Figure 3). In group B, only desloratadine alone was more effective than placebo (Table 2, Figure 3)

Secondary Efficacy Outcomes

Use of rescue medication

The average use of topical decongestant rescue medication during the 6-week treatment periods was greater in patients treated with placebo (6.95 [1.33] group A, 5.35 [1.01] group B) than in patients treated with montelukast alone (1.5 [0.3] group A, 1.35 [0.24] group B), antihistamine alone (1.3 [0.2] for levocetirizine, 1.3 [0.36] for desloratadine) or the combination of montelukast with antihistamine (1.4 [0.31] group A, 1.29 [0.3] group B). There were no significant differences in the rescue medication used.

Adverse Events

There were no severe adverse events in the study. The overall incidence of adverse events was similar for placebo, montelukast, levocetirizine, and combination therapy in both groups.

Use of Sleep Medication

Only 14 patients (8 in group A and 6 in group B) used sleep medication before the study. During the study, sleep medication was prohibited and the need for this treatment was noted by these patients on their diary cards. Patients wanted to use sleep medication more often when they were treated with placebo (5.62 [0.72] / 6 weeks in group A, 3.83 [0.4] / 6 weeks in group B) than when they were treated with montelukast, (1.87 [0.28] in group A, 1.5 [0.55] in group B), antihistamine (1.75 [0.28] in group A, 1.33 [0.27] in group B), or the combination of montelukast and the antihistamine (1.8 [0.35] in group A, 1.33 [0.16] in group B) in both arms of the study.

Discussion

Allergic rhinitis is the most common allergic disease worldwide and affects about 18% to 40% of the general population. Persistent allergic rhinitis is an allergic inflammation of the upper respiratory tract due to a year-round encounter with allergens. If left untreated, a chronic state of nasal inflammation accompanied by nasal obstruction can develop and lead to sinusitis, otitis media with effusion, nasal polyps, and asthma [1].

Nasal obstruction, a major symptom of persistent allergic rhinitis, is difficult to treat. Reduction of air passage through the nasal cavities results from the complex network of inflammatory and neurogenic phenomena that induces mucosal accumulation of inflammatory cells, engorgement of sinusoidal capacitance vessels, increased permeability of blood vessels, and mucous production. Nasal blockage is troublesome and

has a considerable impact on quality of life [1]. A vicious cycle starts with nasal congestion, which elicits breathing through the mouth, difficulties in falling asleep, nighttime awakening, snoring, nasal congestion on awakening with consequent daytime somnolence, impaired mood, poor memory, and decreased productivity at school and work. Patients feel they lack adequate sleep, yet they suffer from insomnia. Sleep impairment leads to an increase in the consumption of sedatives and sleeping medication, which only serves to intensify the problem. The effect of persistent allergic rhinitis on sleep is more pronounced when the condition is moderate-to-severe. Furthermore, anti-allergic medicines (eg, some antihistamines) can cause adverse events such as somnolence and can have an additional negative impact on quality of life. Optimal pharmacotherapy for persistent allergic rhinitis must not only control symptoms, but should also help patients function better during the day and improve their quality of life.

The results of this study demonstrate that therapy with placebo, as well as treatment with montelukast, desloratadine, and levocetirizine, each as monotherapy or in combination (antihistamine plus antileukotriene), results in a significant improvement in the quality of life of patients suffering from persistent allergic rhinitis. Symptomatic patients treated for 6 weeks with montelukast, desloratadine, or levocetirizine, or with a combination experienced significantly greater improvements in HRQL than did patients treated with placebo. The benefits of montelukast, levocetirizine, or desloratadine as monotherapy or in combination were evident in most domains measured by RQLQ, specifically in allergic rhinitis symptoms (except congestion), activity limitations, practical problems, and mood and emotions. Patients in both groups experienced changes that for them were of at least minimal importance (for placebo, 0.5 points in group A and B) or moderate importance (1.0 point for montelukast, levocetirizine and the combination of montelukast with levocetirizine in group A, and for montelukast, desloratadine, and the combination of montelukast and desloratadine in Group B). Although there were no statistically significant differences between the antileukotriene, either antihistamine, or the combination therapy in both groups, only the combination therapy with montelukast and antihistamine in both groups, and desloratadine in group B produced a minimal change (0.5 points) when compared with placebo. These minimal changes noted with placebo may be due to the small sample size and the traditional placebo effect seen in subjective assessment-based studies. Furthermore, patients treated with placebo in this study used significantly more topical decongestants on demand as rescue medication, which may have had some impact on the reported improvements.

These results agree with those of previous studies, which show that monotherapy with montelukast [6,11], desloratadine [12], or levocetirizine [13,14,15] produces a greater improvement in quality of life than placebo in patients affected by persistent and/or perennial allergic rhinitis. There are no previous reports on the improvement in quality of life in patients with persistent allergic rhinitis treated with the combination of montelukast and levocetirizine or desloratadine. Furthermore, there are no studies comparing the efficacy of such combination therapy with monotherapy with desloratadine, levocetirizine, or montelukast.

The improvement in quality of life depends mainly on the reduction of nasal obstruction, as nasal blockage is a crucial symptom in persistent allergic rhinitis that leads to sleep impairment and subsequent daytime somnolence, fatigue, and reduced productivity.

We previously reported that montelukast, desloratadine, and levocetirizine [16] could reduce nasal congestion in persistent allergic rhinitis. This effect agrees with other studies on intermittent and/or seasonal [2-5] and persistent and/or perennial allergic rhinitis [13,16-24]. We demonstrated that montelukast was as efficacious in the improvement of nasal congestion as desloratadine or levocetirizine, and that it was more efficacious than placebo. Furthermore, combination therapy was more effective than monotherapy with montelukast alone (in Group A) and more effective than monotherapy with montelukast or desloratadine (in Group B) [16].

This study does not strictly corroborate the nighttime symptoms score extracted from the RQLQ. The improvement in nasal problems was the same in patients treated with montelukast, desloratadine, levocetirizine alone, or the combination of the montelukast and levocetirizine in both groups, and except for the combination of montelukast and levocetirizine in group A, this improvement was the same as that observed in patients treated with placebo.

Using the 0-3–point nighttime symptoms score evaluated using the diary cards, we noted that, in group A, montelukast, levocetirizine, and the combination of montelukast and levocetirizine gave the same improvement and were more effective than placebo, but that in group B, only montelukast was more effective than placebo, although montelukast, desloratadine, and the combination of montelukast and desloratadine significantly improved nighttime symptoms scores.

There was no additional benefit in nighttime symptoms score in patients treated with the combination of montelukast and an antihistamine either in the RQLQ or the 0-3–point scale nighttime symptoms questionnaire.

The lack of complete harmony between HRQL improvement and nighttime symptom score may be due to the small number of patients and differences in personal subjective assessments of nighttime problems. Furthermore, congestion is not the only symptom that affects quality of life. The improvement in other symptoms such as sneezing, itching, cough, and the diminished uptake of sleep medication and rescue medication in patients treated with montelukast, desloratadine, levocetirizine or the combination of montelukast and an antihistamine may be important.

In conclusion, combination therapy with montelukast and an antihistamine may have a positive impact on persistent allergic rhinitis and improve quality of life and nighttime symptoms. Much of this benefit is probably due to the effect of the combination of montelukast plus either of the newer generation antihistamines on nasal congestion, a symptom with a considerable impact on quality of life. This study provides further support for the utility of combination therapy (montelukast plus either desloratadine or levocetirizine) as a more effective strategy than monotherapy in the treatment of persistent allergic rhinitis in patients with moderate-to-severe symptoms.

No pharmaceutical company contributed to the design or implementation of this study.

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