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ORIGINAL STUDY

Rhinomanometry assesment of outcomes after intranasal corticotherapy in allergic rhinitis

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ABSTRACT

BACKGROUND. Chronic allergic hypertrophic rhinitis is a common condition found in medical practice, characterized by increased volume of the inferior turbinate mucosa. The most frequent symptom reported by the patients is nasal obstruction. The main goal of the therapeutic plan is to treat nasal congestion and inflammation, intranasal corticosteroids representing the first choice.

OBJECTIVE. The study presents the authors' experience in objective evaluation of the therapeutic results after 6 months administration of intranasal mometasone furoate in each nostril.

MATERIAL AND METHODS. A six months prospective study was performed on 106 patients diagnosed with chronic allergic hypertrophic rhinitis. Patient's assessment and reassessment consisted in nasal endoscopy, rhinomanometry, subjective visual analogue scale and allergic skin prick tests in order to identify the sensitization.

RESULTS. The reevaluation performed after 6 months showed a statistically significant improvement in nasal obstruction in 31.13% of the patients. The rhinomanometric measurements revealed an improvement of nasal patency with a significant reduction ($p<0.05$) of the nasal airway resistance (NAR). The mean value of total NAR before treatment was 1.07 Pa/ccm/s at 150 Pa. Rhinomanometry performed after 6 months showed a reduction in mean total resistance from the pretreatment level to 0.78 Pa/ccm/s. The objective data were similar to the VAS results.

CONCLUSION. Intranasal corticotherapy is the first choice in the management of allergic rhinitis. The use of rhinomanometric measurements before and after treatment represents a specific and useful way to evaluate nasal obstruction due to chronic allergic hypertrophic rhinitis.

KEYWORDS: allergic rhinitis, nasal obstruction, intranasal corticosteroids, rhinomanometry

INTRODUCTION

Allergic rhinitis (AR) is a major health problem with high and increasing prevalence[1]. At least one in five adults in Western Europe are estimated to have AR[2], and its well-known nasal and eye symptoms can be severe enough to have a substantial negative impact on daily activities and sleep, with resulting impairment of the quality of life (QoL), similar to that caused by asthma[3].

According to the Joint Task Force on Practice Parameters in Allergy, Asthma and Immunology, rhinitis is the "inflammation of the membrane lining the nose, characterized by nasal congestion, rhinorrhea, sneezing, itching of the nose and/or post-nasal drainage"[4]. Nasal inflammation is the result of a hypersensitivity reaction, mediated by IgE antibodies, to a specific allergen, occurring in sensitized patients[5]. The early-phase response is prompted by histamine released after allergen exposure and results in the acute symptoms of sneezing, nasal pruritus, rhinorrhea, nasal congestion and ocular itching, redness and tearing. Some hours later, the late-phase reaction occurs and is marked by activation of eosinophils and Th_2 lymphocytes, leading to chronic nasal congestion, postnasal drip and nasal hyperreactivity.

Management of AR is important for preventing the symptoms, but also for preventing potential complications of the disease. The options for treatment include lifestyle and avoiding allergens, pharmacotherapy (antihistamines, corticosteroids, decongestants, cromones, leukotriene inhibitors), immunotherapy and surgical treatment (in case

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of severe drug-resistant hypertrophy of the nasal inferior turbinates)[3]. The Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines[3] and the European Academy of Allergology and Clinical Immunology (EAACI) consensus statement[6] note that intranasal corticosteroids are a highly effective first-line treatment for moderate/severe or persistent AR, because they relieve symptoms to a greater degree than other classes of drugs and are especially effective in controlling nasal congestion. The anti-inflammatory properties of topic corticosteroids may explain their strong effect on clinical symptoms.

The objective of this study was to evaluate the mid-term objective (rhinomanometry) and subjective outcomes of management of nasal congestion with intranasal steroid therapy.

MATERIAL AND METHODS

A 6 months prospective clinical study was performed on 106 adult patients with allergic rhinitis, aged between 23 and 62 years (mean age=37.62 years), 57 males and 49 females (male:female=1.61:1).

The study exclusion criteria were pregnancy, childhood, cardiovascular diseases including arterial hypertension, pulmonary comorbidities (asthma), dermatological diseases that could interfere with allergy skin tests, uncooperative patients.

We included in this study patients diagnosed with allergic rhinitis (positive allergic skin prick tests, in order to identify the sensitization) who had a subjective and objective improvement in nasal breathing after nasal mucosa decongestion.

Patients' examination consisted in detailed anamnesis, as well as subjective visual analogue scale (VAS), in order to identify the bothersome symptoms and to appreciate their intensity. Anterior and posterior rhinoscopy, nasal endoscopy were performed in all patients. The diagnosis of AR was established only after the allergologic examination – skin prick tests, serum allergen-specific IgE to common aero-allergens.

In order to assess the nasal airway patency, the 4-phase-rhinomanometry was used. The measurements were performed before and after decongestion (10 minutes with xylometazoline hydrochloride) in order to measure the nasal mucosa response.

The treatment strategy consisted of intranasal topic steroids (mometasone furoate) used for 6 months twice daily, each nostril (100 mcg daily). All patients received the same topic steroid.

The reevaluation was performed after 6 months and consisted of ENT examination, nasal endoscopy, rhinomanometry and subjective assessment (visual analogue scale – VAS).

The method of computerized rhinomanometry was employed by using the 4-Phase-Rhinomanometer (4RHINO) from RhinoLab. The pressure threshold of 150 Pa/cm^3/s was used and clinical classification of obstruction followed the ISOANA parameters (Table 1).

RESULTS

Many patients poorly perceive nasal symptoms of allergic rhinitis: some exaggerate symptoms, whereas many others tend to dismiss the disease. In our study group, most patients presented to the doctor for nasal symptoms: nasal congestion (106 patients – 100%), serous rhinorrhea (87 patients – 82.07%) or sneezing (62 patients – 58.49%). Other bothersome symptoms were clogged ear sensation (48 patients – 45.82%) and sleep disorders (31 patients – 29.24%) (Table 2).

ENT clinical evaluation (anterior and posterior rhinoscopy) and nasal endoscopic examination revealed different grades of hypertrophy of the nasal inferior turbinates (Figure 1), serous rhinorrhea, pale and boggy nasal mucosa (Figure 2).

The objective measurement of nasal obstruction was made using the 4-phase-rhinomanometry (4RHINO from RhinoLab). According to the rhinomanometric results, 20.75% of the patients presented a low nasal obstruction, 32.07% - moderate nasal obstruction and 47.17% - severe nasal obstruction (Table 3).

From the subjective point of view, the most bothersome symptom was nasal obstruction and almost half of the patients had severe nasal obstruction before treat-

Table 1
Nasal obstruction classification

	Log10R(VR, REFF)	Obstruction, Resistance	Conductance
1	<= 0.75	very low	very high
2	0.75 - 1.00	low	high
3	1.00 - 1.25	moderate	moderate
4	1.25 - 1.50	high	low
5	> 1.50	very high	very low

Table 2
Symptoms of patients with allergic rhinitis

Symptoms	Patients	
	Number	Percent
Nasal congestion	106	100%
Serous rhinorrhea	87	82.07%
Sneezing	62	58.49%
Clogged ear sensation	48	45.82%
Sleep disorders	31	29.24%

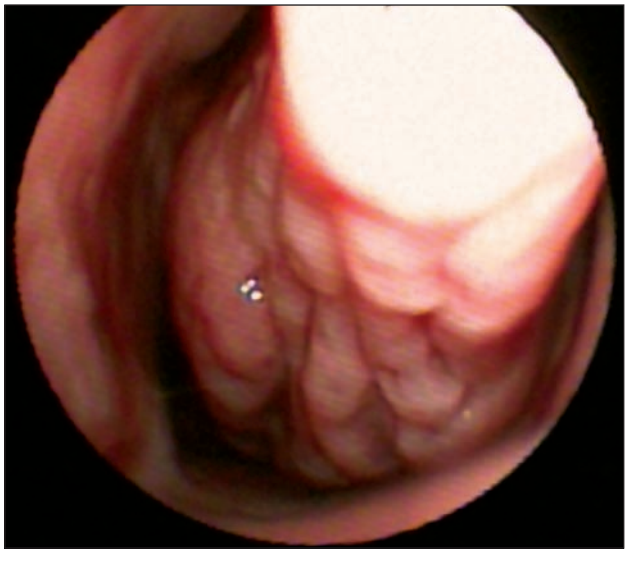


Figure 1 Inferior turbinate hypertrophy – nasal endoscopic examination

Figure 2 Allergic rhinitis: turbinate swelling with mucosal apposition, sub-mucosal edema and serous discharge – nasal endoscopic examination

ment. The VAS also evaluated the impact of rhinorrhea and sneezing upon patients.

Patients' evaluation was performed after 6 months of treatment. The nasal endoscopic examination revealed a persistent swelling of the inferior turbinates with a reduction of the nasal secretion (comparing to the first evaluation) (Figure 3).

The objective evaluation performed with 4RHINO showed a significant improvement in nasal obstruction in 31.13% of the patients from our study group. From the 50 patients who presented severe nasal obstruction at their first evaluation 40% (20 patients) had a constant evolution and only in 2 patients the measurement revealed a low nasal obstruction. Moderate nasal obstruction was found in 28 patients (56%) (Chart 1).

Table 3
Level of nasal obstruction before treatment

Level of nasal obstruction	Number	Percent
Low	22	20.75%
Moderate	34	32.07%
Severe	50	47.17%

73.53% of the patients who presented a moderate nasal obstruction on the rhinomanometric measurments before treatment (25 patients) presented the same moderate nasal airway resistance (Chart 2). Five patients, representing 14.7%, had a complete recovery of the nasal simptom, presenting a normal nasal airway resistance and normal air-flow. In the same group of patients, 4 of them (11.77%) still presented a low nasal obstruction after 6 months of treatment.

After 6 months of treatment, only 5 patients (22.73%) diagnosed at their first evaluation with low nasal obstruction still presented the same simptom grade, the rest of them having normal parameters on the rhinomanometric measurements (Chart 3).

Looking to the overall rhinomanometric results, 50% of the patients (representing 53 patients) still had a mod-

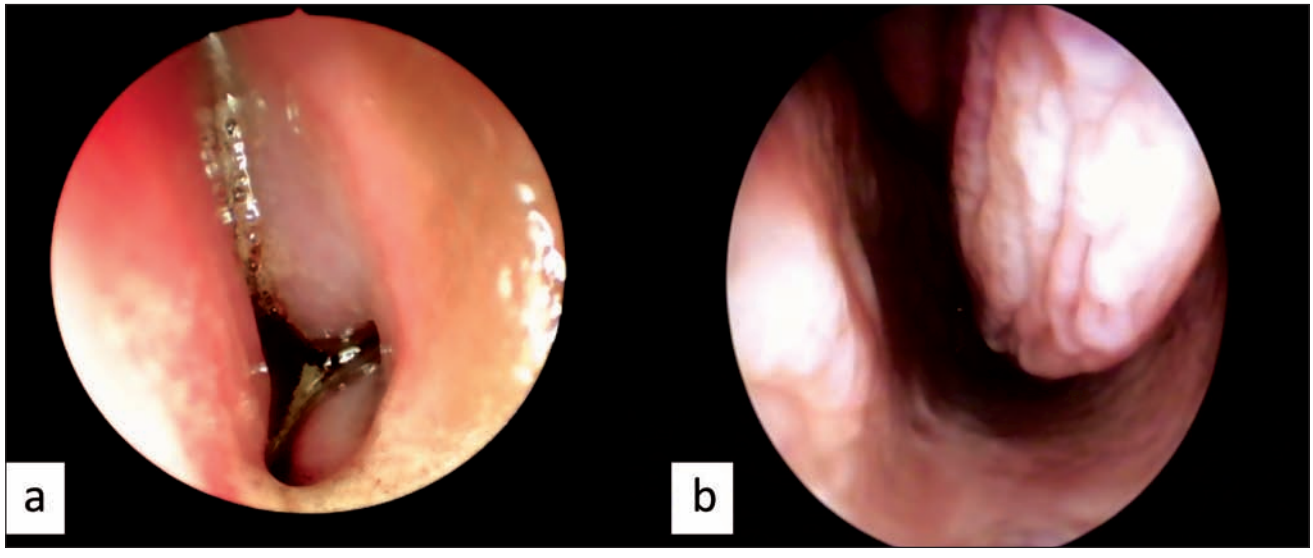


Figure 3 Allergic rhinitis – endoscopic aspect before treatment (a) and after treatment (b)

erate degree of nasal obstruction and 20 patients (18.86%) a severe one (Chart 4). But, in 10.38% of the patients (representing 11 patients), rhinomanometry revealed a low degree of nasal obstruction (Figure 4) and 22 patients (20.76%) presented a normal breathing (Figure 5).

Taking into account the nasal airway resistance (NAR), the rhinomanometric measurements revealed a statistically significant improvement in nasal patency ($p < 0.05$). The mean value of total NAR before treatment was 1.07Pa/ccm/s (ranged between 0.76 and 1.32Pa/ccm/s) at 150Pa (reference pressure). Rhinomanometry performed after 6 months of treatment showed a reduction in mean total resistance from the pretreatment level to 0.78Pa/ccm/s (Chart 5).

Moreover, an increase in nasal air-flow was observed – the mean value before treatment was of 210 ccm/s and after treatment of 389 ccm/s (Chart 6).

All the objective data were similar to the VAS results. The evaluation revealed a significant improvement in the associated symptoms, rhinorrhea and sneezing, but with a poor improvement in nasal obstruction.

DISCUSSIONS

Nasal obstruction is the most bothersome symptom in patients with allergic rhinitis[7,8]. The major mechanism of obstruction is inflammation and it is directly

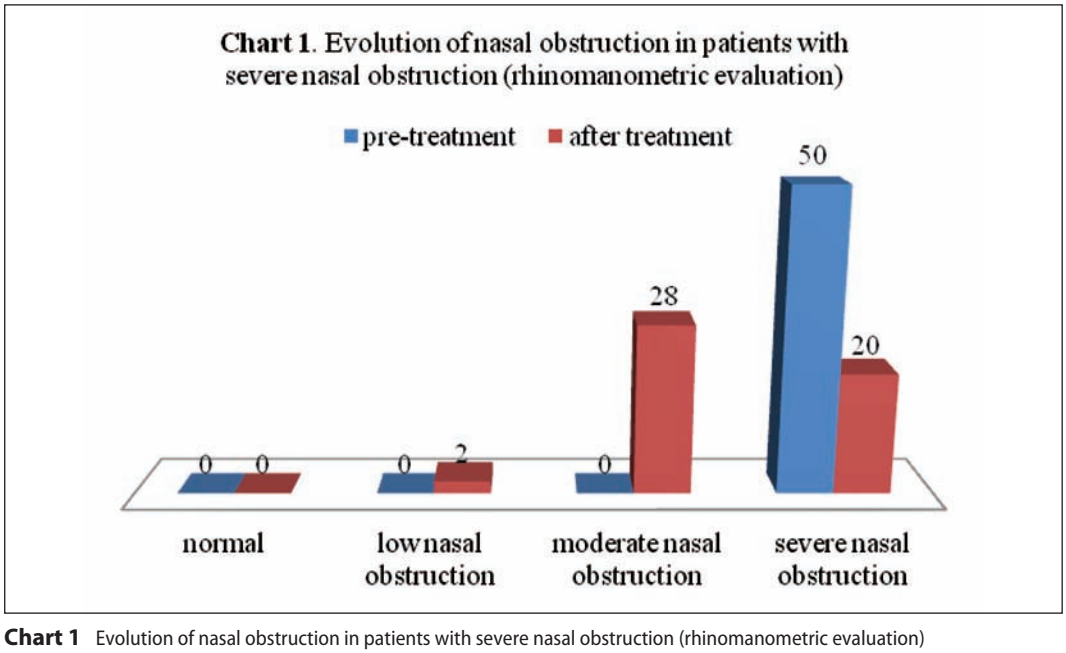


Chart 1 Evolution of nasal obstruction in patients with severe nasal obstruction (rhinomanometric evaluation)

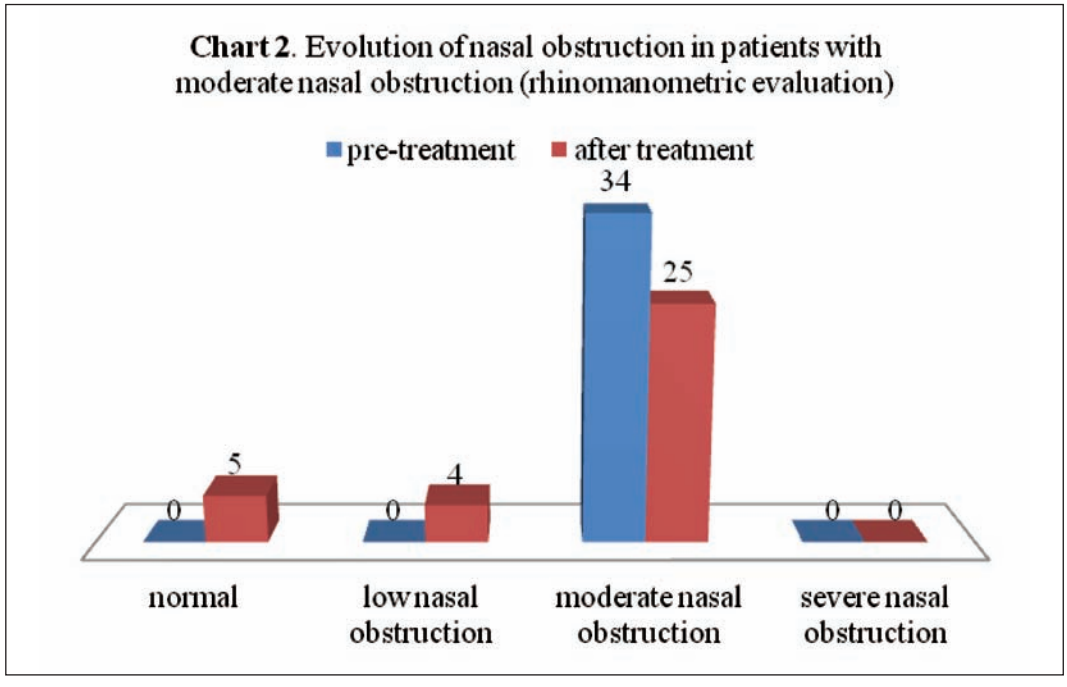


Chart 2 Evolution of nasal obstruction in patients with moderate nasal obstruction (rhinomanometric evaluation)

connected to the degree of nasal obstruction. Both congestion and inflammation can have a negative impact on the health status and also on patients' quality of life. Apart from local disease, allergic rhinitis can cause considerable morbidity, including chronic sinusitis and otitis. The condition can also cause irritability and impaired sleep, which can affect quality of life, by leading to absenteeism from school or work, and chronic tiredness. It can also have detrimental effects on the emotional and social wellbeing[9,10].

Of the classes of pharmacotherapy for seasonal allergic rhinitis, intranasal corticosteroids are the preferred treatment and are recommended in practice guidelines as first-line pharmacotherapy for rhinitis with prominent nasal congestion, which is the most bothersome symptom of allergic rhinitis[11].

Compared to antihistamines, however, they have a slower onset of action (days), and especially beclomethasone at high doses may have a less favourable safety profile for chronic use in children. Oral

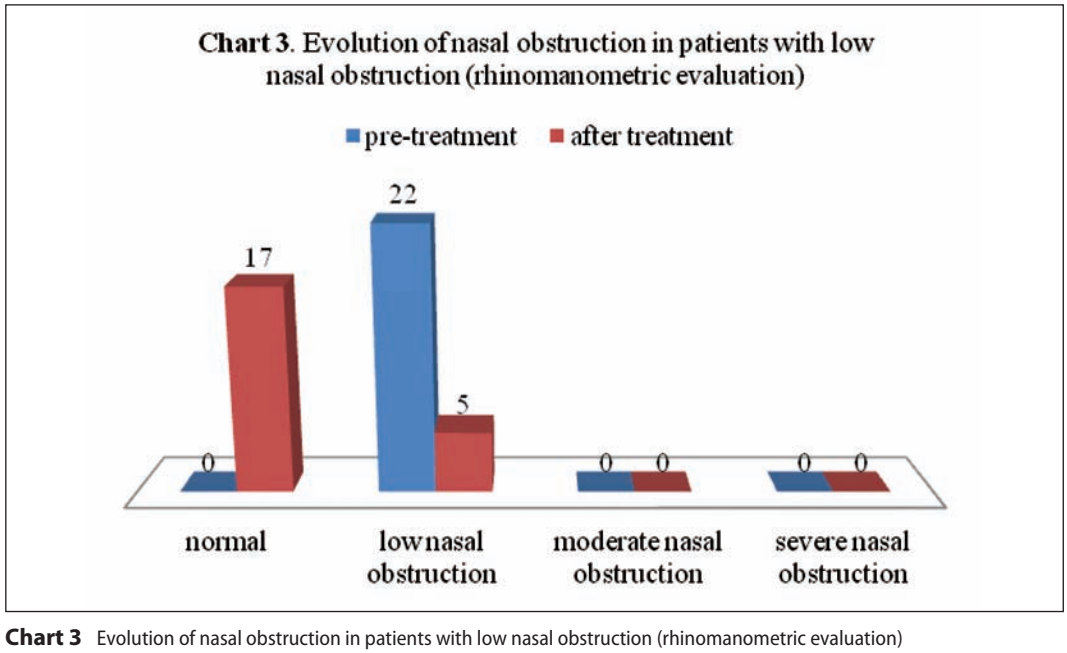


Chart 3 Evolution of nasal obstruction in patients with low nasal obstruction (rhinomanometric evaluation)

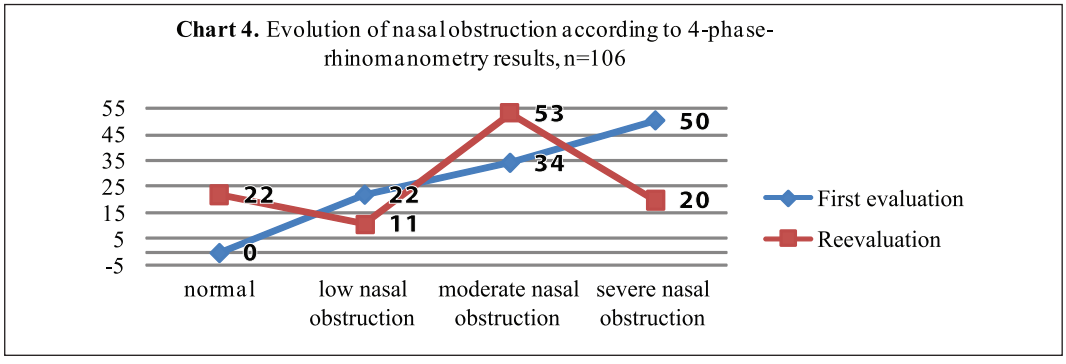


Chart 4 Evolution of nasal obstruction according to 4-phase-rhinomanometry results, n=106

steroids are reserved for very severe cases only, due to serious adverse events from chronic use. Some patients with concomitant asthma may need treatment with both inhaled and oral steroids, so adding a nasal steroid for concomitant rhinitis may not be the primary choice.

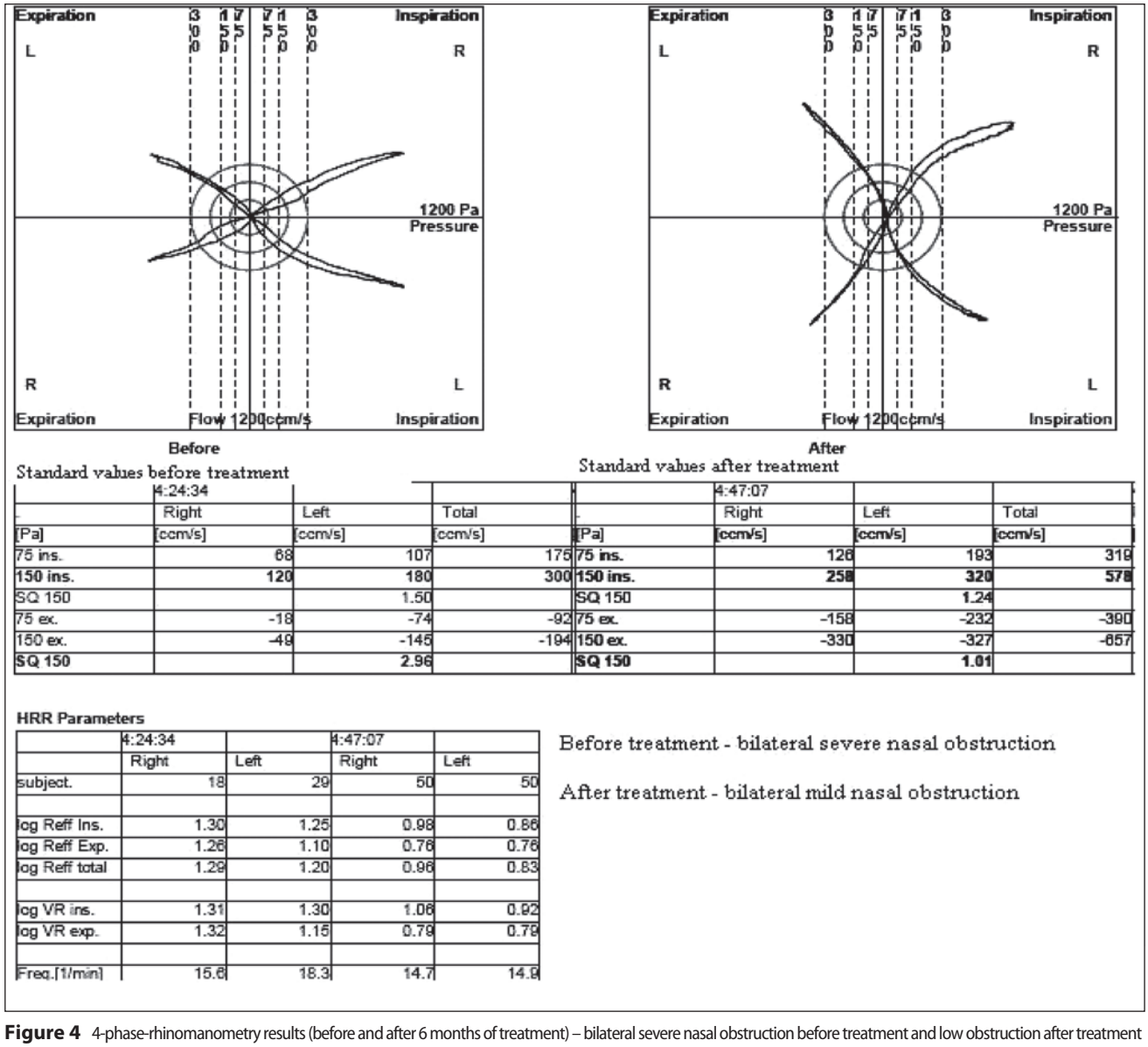
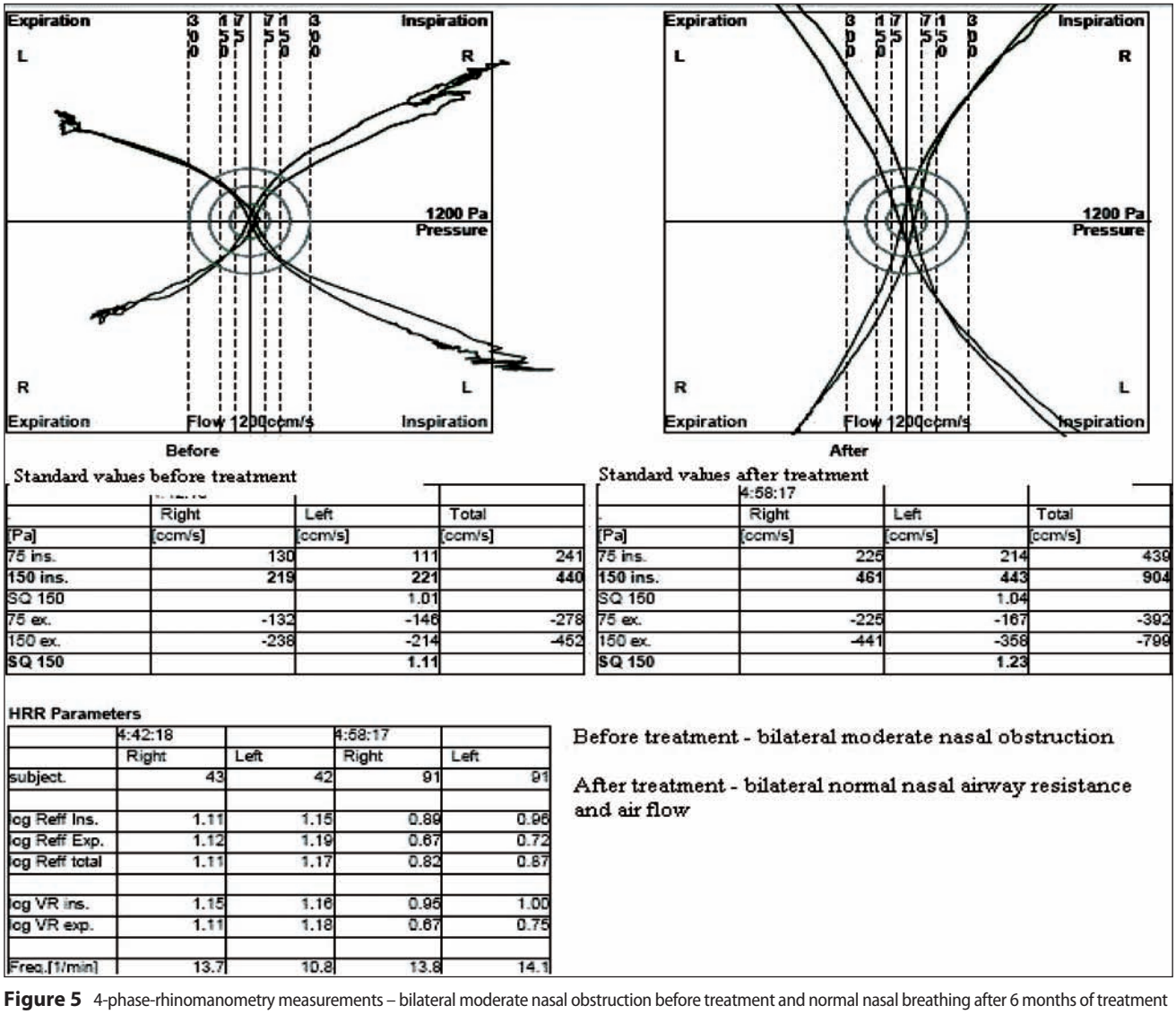


Figure 4 4-phase-rhinomanometry results (before and after 6 months of treatment) – bilateral severe nasal obstruction before treatment and low obstruction after treatment



Standard values before treatment

	Right	Left	Total
[Pa]	[ccm/s]	[ccm/s]	[ccm/s]
75 ins.	130	111	241
150 ins.	219	221	440
SQ 150		1.01	
75 ex.	-132	-146	-278
150 ex.	-238	-214	-452
SQ 150		1.11	

Standard values after treatment 4:58:17

	Right	Left	Total
[Pa]	[ccm/s]	[ccm/s]	[ccm/s]
75 ins.	225	214	439
150 ins.	461	443	904
SQ 150		1.04	
75 ex.	-225	-167	-392
150 ex.	-441	-358	-799
SQ 150		1.23	

HRR Parameters

	4:42:18		4:58:17	
	Right	Left	Right	Left
subject.	43	42	91	91
log Reff Ins.	1.11	1.15	0.89	0.96
log Reff Exp.	1.12	1.19	0.67	0.72
log Reff total	1.11	1.17	0.82	0.87
log VR ins.	1.15	1.16	0.95	1.00
log VR exp.	1.11	1.18	0.67	0.75
Freq.[1/min]	13.7	10.8	13.8	14.1

Before treatment - bilateral moderate nasal obstruction

After treatment - bilateral normal nasal airway resistance and air flow

Figure 5 4-phase-rhinomanometry measurements – bilateral moderate nasal obstruction before treatment and normal nasal breathing after 6 months of treatment

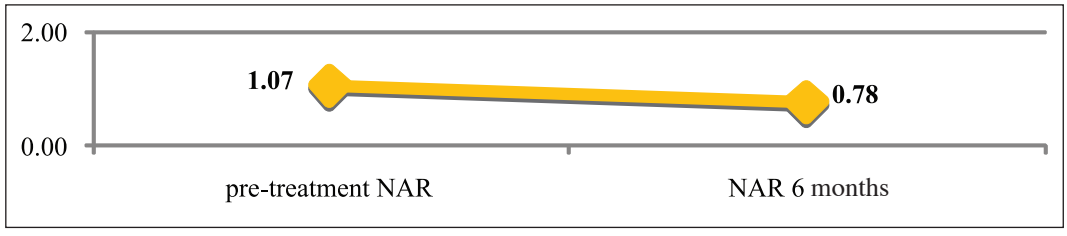


Chart 5 Pre- and post-treatment mean value of total nasal airway resistance (NAR)

Only intranasal corticosteroids have proven anti-inflammatory activity against the pathophysiologic aspects of both early- and late-phase allergic reactions and are effective for the range of nasal symptoms[12]. They inhibit the inflammatory process producing nasal symptoms and consistently alleviate nasal congestion. Corticosteroids differ from oral antihistamines, which are not particularly effective for nasal congestion. In addition, systemic drug exposure and the corresponding risk of systemic side effects are minimal with intranasal corticosteroids[13].

Gross and colleagues[14] have shown in the combined analysis of four studies on allergic rhinitis that intranasal steroids alone reduce less than 40% of the nasal obstruction, with no significant difference between patients who received nasal steroids and placebo. Weiner and colleagues[15] confirmed in their study that intranasal corticosteroids are sig-

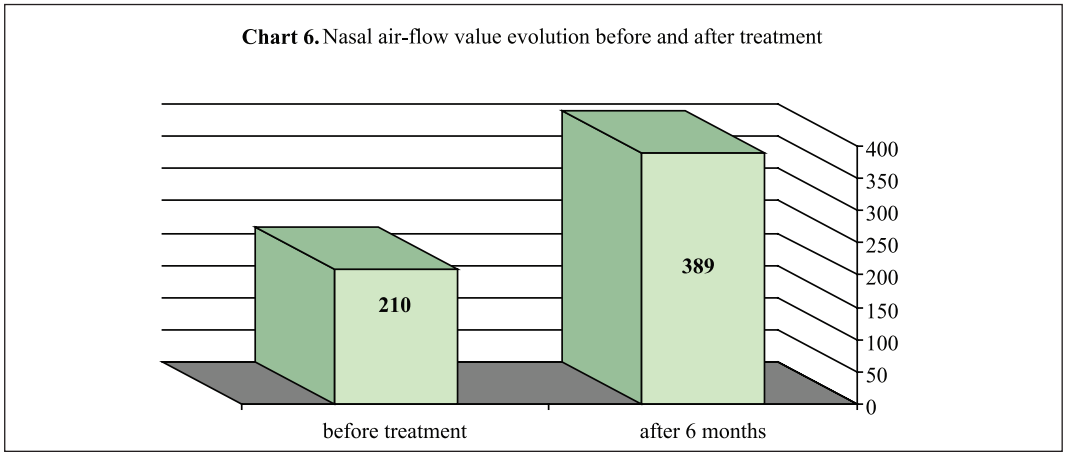


Chart 6 Nasal air-flow value evolution before and after treatment

nificantly more effective in relieving nasal blockage, discharge and itch, and postnasal drip. The results found in the specialty literature are similar to those found in our study.

Even if the overall treatment success is significant, there is a low efficiency of intranasal corticosteroids on nasal obstruction in patients with allergic rhinitis compared to those diagnosed with non-allergic rhinitis. In allergic rhinitis, maximum efficiency is obtained by combining intranasal corticosteroids with antihistamines; they decrease the body's inflammatory response to allergens, thus increasing the effectiveness of topical steroids; they are used in moderate and severe cases of allergy, in combination with intranasal corticosteroids[16].

CONCLUSIONS

The treatment of allergic chronic hypertrophic rhinitis must be standardized according to the severity of its symptoms. Intranasal corticosteroids, in monotherapy, are the main therapeutic option for the treatment of nasal obstruction in allergic rhinitis, even if the treatment has a greater impact upon associated symptoms (runny nose, sneezing, itching).

Patients who do not show significant improvements (rhinomanometric) are proposed for laser surgery or radiofrequency to minimize volume and restore patency of nasal airways.

The use of rhinomanometry measurements before and after treatment represents a specific and useful way to evaluate nasal obstruction due to allergic chronic hypertrophic rhinitis. The calculation of nasal airway resistance is a useful technique in the clinical evaluation, and the objective data provided can assess the efficiency of the treatment.

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