ORIGINAL STUDY

Nasal cytology assessment after topical intranasal corticosteroids therapy in allergic rhinitis

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ABSTRACT

BACKGROUND. Intranasal steroid spray has been proved to be an effective treatment for allergic rhinitis. Efficacy of topical nasal steroid therapy for allergic rhinitis is evaluated by subjective symptom changes assessments and by objective methods.

OBJECTIVE. To determine the utility of nasal cytology as a tool for evaluating the efficacy of intranasal steroids in patients with allergic rhinitis in comparison with subjective evaluation methods.

MATERIAL AND METHODS. The study was performed on 111 adult patients, aged between 18 and 61 years old, with moderate to severe allergic rhinitis. Patients received intranasal corticosteroids 200 ug (Mometasone furoate) twice daily, for 12 weeks. Nasal mucosal specimens for cytology were obtained by the brushing technique with Rhino-probes and stained with May-Grumwald-Giemsa stain. Efficacy was evaluated by nasal symptom scores, eye symptoms, global evaluation and nasal cytology.

RESULTS. Mometasone furoate produced a significantly greater decrease in subjective measures for total symptom score (41.09%), individual nasal symptom scores and overall therapeutic response. Examination of nasal cytograms revealed a striking decrease in both eosinophils and neutrophils in the study group. Adverse effects were uncommon and mild.

CONCLUSION. Nasal cytological assessment is a simple, objective method which provides valuable information about the nasal mucosa. The results of this study indicate that mometasone furoate is effective in decreasing nasal symptoms and eosinophil inflammation in patients with moderate to severe allergic rhinitis. The use of intranasal corticosteroids (INS) is associated with a decrease in the inflammatory cells number noticed on nasal cytology. Intranasal corticosteroids are recommended as a first line treatment of allergic rhinitis.

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KEYWORDS: nasal cytology, allergic rhinitis, mometasone furoate nasal spray, intranasal steroids.

INTRODUCTION

Allergic rhinitis (AR) is the most frequent allergic disease. The Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines classify AR according to its duration and its severity. Even if ARIA also recommends some treatment methods, there is evidence that these guidelines are not sufficiently followed. Allergic rhinitis affects up to 15% of 6 to 7 year olds and 40% of 13 to 14 year olds[1].

Nasal cytology is an important diagnostic tool, currently used in rhinology. It is used to study either rhinological disorder, as infectious, inflammatory or allergic rhinitis[2]. It does not specify the allergen, but can be a screening test, cost effective, in order to determine the presence or absence of allergic rhinitis[3,4].

Different factors have been responsible for the increased interest in this diagnostic tool.

The advantages of this technique are different: it is easy to perform; it is a non-invasive approach, which allows repetition on the same patient, being essential in the follow-up of the disease and in monitoring the efficacy of medical and surgical interventions. Also, it has a low cost and it is suitable, even for children, because it is simple and safe[5, 6].

Nasal cytology is a very useful diagnostic method in nasal diseases, being able to detect the cellular modifications in the nasal epithelium, determined by phys-

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ical or chemical[3,4] factors, acute or chronic irritations. Moreover, it facilitates the evaluation of different types of inflammation (viral, bacterial, fungal or parasitical)[5,6].

Over these past few years, nasal cytology was helpful in identifying new diseases, such as the non-allergic rhinitis with eosinophils (NARES), non-allergic rhinitis with mast cells (NARMA), non-allergic rhinitis with neutrophils (NARNE) and non-allergic rhinitis with eosinophils and mast cells (NARESMA)[7]. The rhinocytogram is able to identify the different forms of allergic rhinitis and to suggest the optimal treatment, such as antiinflammatory drugs or allergen immunotherapy.

Nasal cytology, as a diagnosis tool, is based on the consideration that, in healthy subjects, the nasal mucosa has four normal types of cells, which usually characterize the pseudostratified epithelium; besides neutrophils, no other cells are detected in healthy individuals. On a rhinocytogram, the presence of eosinophils, mast cells, bacteria or fungi is considered a sign of nasal disorder[8].

Samples for nasal cytology may be obtained by scraping the middle portion of the inferior turbinate, where there is an optimal ratio between ciliated and mucous-secreting cells, with predominance of ciliated cells. Usually, nasal swab is preferred to scraping, since it is easier, using the latter only when investigating more collaborative patients.

Nasal pathologies affect, first of all, the ciliated cells, determining a rearrangement of the epithelium, with predominance of mucous-secreting cells (metaplasia). This process has both physiopathological and clinical important consequences, because the increase of mucous-secreting cells leads to a major production of mucus, while the decrease of the ciliated cells determines a low efficiency of the mucociliar transport[9]. These reactions produce the stasis of mucous secretions in the nose, inducing a high risk of bacterial infection. Taking into consideration that the normal turnover of a ciliated cell lasts three weeks, frequent inflammatory processes do not allow a normal ratio between the different cellular types to be established[10].

Patients with allergic rhinitis (AR), when exposed to the incriminated allergen, in the environment or during a nasal provocation test, develop an immediate nasal response, the early-phase response, followed by a late-phase response[11].

From the microscopic point of view, these responses are characterized by a mucosal infiltration with inflammatory cells (eosinophils, mast cells, neutrophils and lymphocytes), which produce IgE-mediated nasal symptoms (pruritus, nasal obstruction, rhinorrhea and sneezing), subsequently to the release of the different chemical mediators (histamine), produced by those cells[12].

When the intensity of allergen exposure is low, but continual, as in persistent rhinitis (caused, for example, by house dust mites allergy), a "minimal persistent inflammation" occurs, characterized by a persistent infiltration of neutrophils and, only minimally, of eosinophils[13, 14]. This particular cellular condition determines a chronic symptomatology, which characterizes the patients suffering from persistent AR. The main symptomatology is represented by nasal congestion and rhinorrhea.

In case of intermittent AR, the rhinocytogram may have different types of cells, according to the period of the year while the patient is examined, during the pollen season or outside the season. Also, during the pollen season, patients have all the clinical signs and symptoms of allergic rhinitis, so that we find at the nasal cytology different subsets of cells: neutrophils, lymphocytes, eosinophils and mast cells, mostly degranulating.

By contrast, in patients evaluated outside the pollen season, there are neither clinical symptoms, nor cytological signs that may be found; that is even more evident if the pollen season and the allergen exposure finished more than 30 days before evaluation. In these cases, for an effective diagnosis, it is important to perform a nasal provocation test with the specific allergen or a cytological study during the peak of pollination.

Nasal cytograms of patients with allergic rhinitis contain elevated numbers of eosinophils and basophilic cells. Neutrophils are also more numerous in rhinocytograms of allergic persons. Mast cells and eosinophils in degranulation are not usually found on the rhinocytograms.

Allergic rhinitis has a great impact on the quality of life, by the importance of the symptoms associated. The optimal treatment for allergic rhinitis has to be able to increase quality of life and provide long-term better outcomes, besides achieving and sustaining symptom suppression[1].

For the treatment of allergic rhinitis, there are various types of medications available, but intranasal corticosteroids are considered the most effective. Intranasal corticosteroids (INSs) are the main therapeutic option used for allergic rhinitis nasal symptoms.

The appearance of corticosteroids delivered directly to the nasal mucosa has reduced the systemic adverse effects, usually associated with oral corticosteroid therapy. Due to the high potency of these drugs and to their extended use in the treatment of allergic rhinitis, it is important to note that intranasal corticosteroids have a positive benefit-risk ratio.

Glucocorticosteroids' main mechanism of action is related to their intracellular glucocorticosteroid receptor and to their impact on nuclear cytoplasmic transcriptional factors. Glucocorticosteroids inhibit gene expression of factors responsible for stimulating

and maintaining inflammatory processes, decrease the levels of proinflammatory cytokines and chemokines production and adhesive molecules expression. It seems that glucocorticosteroids also have other mechanisms of action, which are not related to the intracellular receptors, leading to inhibition of the early and late phase of the allergic reaction. Furoates earn special attention as their molecules are highly lipophilic and are easily absorbed by nasal mucous membranes, epithelium and cell membrane phospholipids. This minimizes their general action and maximizes local action.

It has been proven that topical intranasal corticosteroid therapy for allergic rhinitis is able to decrease the numbers of some inflammatory cell types. The mometasone furoate aqueous nasal spray, a potent synthetic corticosteroid preparation, with antiinflammatory properties, is an effective drug for the treatment and prophylaxis of nasal symptoms of seasonal AR and for the treatment of nasal symptoms of perennial AR; it is also efficacious in nasal polyposis. Nasal congestion associated with allergic rhinitis affect patients' quality of life. The intranasal corticosteroid mometasone furoate nasal spray (MFNS) is effective for AR symptoms, including nasal congestion and it has been proven effective in improving quality of life scores associated with allergic rhinitis. Numerous clinical trials have demonstrated that the mometasone furoate nasal spray effectively relieves nasal congestion in adults and children with AR, while providing excellent safety and tolerability[15].

There is an increasing interest for the role of INSs, including MFNS, in providing effects on the ocular symptoms, which are frequently associated with AR.

Mometasone furoate does not have high systemic concentrations and it does not cause clinically significant adverse effects. The results from extended pharmacokinetic studies, both in adults and in children, prove that systemic exposure to mometasone furoate after intranasal administration is very low[15]. This effect appears probably because of the low solubility of aqueous mometasone furoate, which permits only a small amount of the drug to cross the nasal mucosa and enter the bloodstream. The same effect can be due to the large amount of the intranasal drug that is swallowed and undergoes extensive first-pass metabolism.

The safety and tolerability of mometasone furoate nasal spray have been assessed in multiple clinical trials, performed on approximately 4,500 patients. The results of this study showed that mometasone furoate nasal spray has minor adverse effects associated with treatment, like epistaxis, headache and pharyngitis being the most common in adolescents and adults[16].

The clinical efficacy of mometasone furoate nasal spray, along with its high safety and tolerability profile, provides and sustains its favourable benefit-risk ratio[16].

OBJECTIVE

The purpose of the study was to evaluate symptom scores and nasal cytology findings in patients with persistent, moderate to severe allergic rhinitis, before and after treatment with intranasal steroids. We also correlated the grade of nasal smear eosinophilia with increasing severity of allergic rhinitis. We attempt to define the severity of AR by nasal cytology on the basis of the ARIA classification.

MATERAL AND METHODS

We performed a prospective clinical study on 111 patients diagnosed with persistent, moderate to severe allergic rhinitis. Patients' assessment and reassessment consisted in clinical examination, nasal endoscopy, allergy testing and nasal cytology, before and after a 3-month treatment with mometasone furoate twice daily, each nostril (200 ug).

Diagnosis of moderate-severe allergic rhinitis established clinically and endoscopically confirmed allergy.

Inclusion criteria were:

- Age> 18 years;
- Skin tests performed at baseline;
- Positive skin tests and/or serological;
- Male, female;
- Patients compliant, willing to periodic evaluation by completing an informed consent;
- Patients' accept to be included in the research group.

The standard protocol for diagnosing allergic patients included flexible and/or rigid endoscopic investigations, and allergy skin tests.

Patients with diseases and/or treatments that could alter the outcome of these tests were excluded. We also excluded non-compliant patients, psychiatric diseases and dermographism that could alter the results to skin prick tests.

We clinically defined AR according to the ARIA classification. Suspected allergic rhinitis (AR) was confirmed after the skin prick test (SPT) with persistent, moderate to severe allergic rhinitis.

Nasal (nasal obstruction, rhinorrhea, sneezing, nasal itching) and ocular symptom (itching, erythem) scores were recorded before and after treatment, according to the Visual Analogue Scale, from 0 (symptoms absent) to 10 cm (the highest intensity).

Prick tests to assess allergic rhinitis were carried out according to the European standards and guidelines, with a panel of commercial extracts[17] (Table 1).

Nasal cytology was performed by anterior rhinoscopy and consisted of scrapings obtained from the middle portion of the inferior turbinate, using a Rhinoprobe (Apotex Scientific, Inc. Arlington, Texas) be-

Table 1
Standard prick test panel for inhalant allergens

Allergen/control
Histamindihydrochloride 0,1 % (positive control)
NaCl 0.9% (negative control)
Hazel Corylus avellana
Alder Alnus incana
Birch Betula alba
Plane Platanus vulgaris
Cypress Cupressus sempervirens
Grass mix smooth meadow grass/Poa pratensis, cock's foot grass/Dactilis glomerata, perennial rye grass/Lolium perenne, timothy grass/Phleum pratense, meadow fescue/Festuca pratensis, meadow oat grass/Helictotrichon pretense
Olive Olea europaea
Mugwort Artemisia vulgaris
Ragweed Ambrosia artemisii folia
Alternaria Alternaria alternata (tenuis)
Cladosporium Cladosporium herbarum
Aspergillus Aspergillus fumigatus
Parietaria Parietaria
Cat
Dog
Dermatophagoides pteronyssinus
Dermatophagoides farinae
Blatella Blatella germanica

fore and after therapy with mometasone aqueous nasal spray. The following steps characterize the cytological technique: sampling, processing (with fixing and staining), and observation through optical microscopy.

The scraped material was transferred on a glass slide, air-dried and stained by May-Grunwald-Giemsa (MGG) (Carlo Erba, Milan, Italy). The "infectious spot", expression of biofilms, appeared as typical cyan-color patches including bacteria or fungi[7,11]. The slides were examined by a Nikon E600 light microscope (Nikon, Canada) and 50 microscopic fields were read at a magnification of 1000x, to assess the presence of normal and abnormal cellular elements. A semi-quantitative grading was used, according to Meltzer[18].

The presence of cells, bacteria and/or fungal spore was graded as follows: Grade 0 = not visible; Grade 1+ = occasional groups; Grade 2+ = moderate number; Grade 3+ = easily visible; Grade 4+ = covering the entire field.

Slides should be graded from 0 to 4+ for neutrophils, basophils, and Eosinophils. Results: 1) No Eosinophils seen = 0; 2) 1-3 small cluster(s) per LPF = 1+; 3) 4-8 small to medium clusters per LPF = 2+; 4) 3-10 medium clusters per LPF = 3+; 5) 1 or more large clusters per LPF = 4+. (*NOTE: *LPF: Low Power Field**)

Statistical analysis was performed by a parametric test using a statistical software (SPSS version 15.0); significance was set at p=0.05. Data are presented as mean ± SD and median. A Student *t* or a Mann-Whitney test was used for comparison of two different groups and an ANOVA test or Kruskall-Wallis test for more than two groups. Kendall's tau-b correlation was used to assess correlation. A P-value < 0.05 was considered significant.

RESULTS

We performed a prospective clinical study on 111 patients, 59 females and 52 males, with sex ratio 1.13. Patients were aged between 18 and 61 years old. The average age in our study group was 35.25 years.

We identified allergic comorbidities in 58 patients – 52.25%, distributed equally between males and females (29 males, 29 females). NSAIDs intolerance was found in 32 patients (19 females, 13 males), while asthma was the most frequent allergic condition associated – 45.94%, 52 patients (28 females, 24 males). Other allergies were noted in 17 patients (8 females, 9 males), especially to antibiotics.

As smoking could be a risk factor in the severity of symptoms in allergic rhinitis, we also assessed the smokers 53 patients – 47.47% (25 females, 28 males) and non-smokers.

The most frequent allergens were house dust mites (both Der-p and Der-f) – 47.74%.

Other allergens were: dog epithelium 9.90%, cat epithelium 15.31%, Aspergillus 8.10%, Blatella 9%, grass mix 44.14%, birch (Betula alba) 16.21%, ragweed (Ambrosia) 15.31%, Artemisia vulgaris 12.61%, Parietaria 5.40%.

Mometasone furoate has a potent activity in all patients, no matter the sensitization. Patients allergic to Ambrosia have ocular symptoms poorly controlled by topical steroids; in addition, they need supplementary therapy before and during the season.

The most bothersome symptom was, as expected, nasal obstruction (average score 6.957 ± 0.9784), followed by, in order, rhinorrhea (6.49 ± 1.192), nasal itching (5.225 ± 1.4546), ocular symptoms (5.194 ± 1.7805) and sneezing (4.167 ± 1.6302). The average score for global assessment was 7.278 ± 0.8731. All symptoms were reduced ($p<0.0005$, Wilcoxon Signed Ranks Test). The Visual Analogue Scale score after treatment was significantly lower in our study group, as the global evaluation decreased with 41.09%.

After treatment, symptom scores were significantly lower: nasal obstruction (3.941 ± 1.2887), nasal itching (3.561 ± 1.3883), rhinorrhea (4.071 ± 1.3016), sneezing (2.642 ± 1.3983), ocular manifestations (3.964 ± 1.5574). VAS for global symptoms was 4.287 ± 1.5103.

Nasal obstruction decreased by 43.35%, while nasal itching was with 45.43% lower than at inclusion. Rhinorrhea was also diminished significantly 58.6%, as well as sneezing 35.33%. Scores for itching of the eyes were reduced with 44.30%.

There was statistically significant (Table 2) decrease from baseline in blocked nose, sneezing, running nose, ocular manifestations and nasal pruritus ($p<0.001$). Few patients had no improvement or minor improvement in symptoms.

The adverse events reported by the patients were nasal bloody discharge, sensation of nasal dryness and headache. The most common adverse effects associated with mometasone furoate were epistaxis (3.60%), throat irritation (4.50%) and nasal dryness, burning and stinging (3.60%). Most were mild, self-limiting and were resolved without discontinuing therapy.

Nasal cytology detected neutrophils in 76 patients (68.46%), eosinophils in 85 patients (76.57%), mast cells in 21 patients and lymphocytes in 4 patients. Twenty nine out of 111 patients with AR had a significant number (+++, ++++) of eosinophils and 13 patients had high levels of neutrophils (+++, ++++) at the nasal cytology, documenting the presence of "minimal persistent inflammation". Six out of 111 AR patients – 5.40% - showed a positive swab for bacteria and 3 patients for fungi.

Rhinocytograms and cytological evaluation revealed a decrease ($p<0.005$) in the presence of eosino-

Table 2
Correlation of symptoms before and after therapy

Variable	Time		p-value test = Paired Samples Test	Score correlation before and after
	Before treatment	After treatment		
Obstruction	6.957±0.9784	3.941±1.2887	0.000000	0.509
Itching	5.225±1.4546	3.561±1.3883	0.000000	0.750
Rhinorrhea	6.49±1.192	4.071±1.3016	0.000000	0.569
Sneezing	4.167±1.6302	2.642±1.3983	0.000000	0.843
Ocular	5.194±1.7805	3.964±1.5574	0.000000	0.859
VAS global	7.278±0.8731	4.287±1.5103	0.000000	0.515

phils (Table 3), neutrophils (Table 4) and mast cells (Table 5), as well as the total number of cells, after three months treatment with mometasone furoate, using Wilcoxon Signed Ranks Test. Mometasone furoate has a potent activity on eosinophils, neutrophils and mast cells($p<0.005$).

Most patients had no neutrophils or had low levels (+): 50.45, the rest had a more important inflammation (++, +++, ++++ - 2 patients).

After a 3-month treatment, 67.6% had no neutrophils on nasal cytology and 23.4% had low levels of neutrophils. At the end of the treatment, only 9% of

Table 3
Eosinophils evaluation before and after treatment – nasal cytology

			eos2					
			Abs	+	++	+++	++++	Total
eos1	Abs	Count	26	0	0	0	0	26
		% within eos1	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	+	Count	22	2	0	0	0	24
		% within eos1	91.7%	8.3%	0.0%	0.0%	0.0%	100.0%
	++	Count	16	14	2	0	0	32
		% within eos1	50.0%	43.8%	6.2%	0.0%	0.0%	100.0%
	+++	Count	3	10	6	1	0	20
		% within eos1	15.0%	50.0%	30.0%	5.0%	0.0%	100.0%
	++++	Count	3	3	1	0	2	9
		% within eos1	33.3%	33.3%	11.1%	0.0%	22.2%	100.0%
	Total	Count	70	29	9	1	2	111
		% within eos1	63.1%	26.1%	8.1%	0.9%	1.8%	100.0%

Table 4
Neutrophils evaluation before and after treatment – nasal cytology

			neutr2				
			Abs	+	++	+++	Total
neutr1	Abs	Count	34	0	0	1	35
		% within neutr1	97.1%	0.0%	0.0%	2.9%	100.0%
	+	Count	18	3	0	0	21
		% within neutr1	85.7%	14.3%	0.0%	0.0%	100.0%
	++	Count	21	18	3	0	42
		% within neutr1	50.0%	42.9%	7.1%	0.0%	100.0%
	+++	Count	2	4	5	0	11
		% within neutr1	18.2%	36.4%	45.5%	0.0%	100.0%
	++++	Count	0	1	1	0	2
		% within neutr1	0.0%	50.0%	50.0%	0.0%	100.0%
	Total	Count	75	26	9	1	111
		% within neutr1	67.6%	23.4%	8.1%	0.9%	100.0%

the patients still had important neutrophils on rhinocytograms (Table 4).

In the study group, in most patients – 81.08%, we did not identify any mast cells on the cytology samples (Table 5).

According to the results of our study, mometasone furoate did not have a statistical significant effect on lymphocites (p-value = 0.0832), bacteria (p-value = 0.0683) and fungi (p-value = 0.1572) (Table 6).

Lymphocytes were found in only 4 patients.

Bacteria were found in 6 patients at first examination, of which 5 had a positive response at the therapy and they had lower levels. Fungi were absent in almost all cases and they did not interfere with the therapeutic response.

DISCUSSIONS

Symptom scoring systems are widely used for the evaluation of treatment efficacy in allergic rhinitis treatment. When investigating the disease and monitoring the therapeutic response, we also need to use objective methods.

Nasal cytology, as a method used for the assessment of the patients with allergic rhinitis, was studied

Table 5
Mast cells evaluation before and after treatment – nasal cytology

			masto2				
			Abs	+	++	+++	Total
masto1	Abs	Count	88	0	1	1	90
		% within masto1	97.8%	0.0%	1.1%	1.1%	100.0%
	+	Count	7	2	0	0	9
		% within masto1	77.8%	22.2%	0.0%	0.0%	100.0%
	++	Count	2	3	0	0	5
		% within masto1	40.0%	60.0%	0.0%	0.0%	100.0%
	+++	Count	2	3	2	0	7
		% within masto1	28.6%	42.9%	28.6%	0.0%	100.0%
	Total	Count	99	8	3	1	111
		% within masto1	89.2%	7.2%	2.7%	0.9%	100.0%

Table 6
Lymphocytes evaluation before and after treatment – nasal cytology

			lymf2		
			Abs	+	Total
lymf1	Abs	Count	107	0	107
		% within lymf1	100.0%	0.0%	100.0%
	+	Count	3	1	4
		% within lymf1	75.0%	25.0%	100.0%
	Total	Count	110	1	111
		% within lymf1	99.1%	0.9%	100.0%

during the time. It has been proven that it is a simple, objective method, providing us valuable and important information about the nasal mucosa[19].

It was observed that pollen-induced AR can determine increased levels of tissue inflammatory cells (eosinophils, neutrophils and mast cells), compared to other allergens. Besides the differences regarding the cellular subsets, identified for eosinophils and mast cells, some modifications were noted also regarding the degranulation level, which varies according to the specific pollen (grass, parietaria, cypress and olive). Nasal eosinophilia is a characteristic for allergic diseases at all ages, but the presence of intra- and extracellular bacteria is the mark of a concomitant bacterial infection (allergic rhinosinusitis).

From the intranasal corticosteroids used in the management of the patients with allergic rhinitis, mometasone furoate improved nasal symptoms, sleepiness and impairment in daily activities, as it has been shown in several studies.

Besides reducing nasal symptoms, mometasone furoate also improves performance, which suggests that the administration of mometasone furoate may have positive effects upon sleep and daytime functioning[20].

Furthermore, in patients with AR, INSs tend to decrease the substance P concentration in tears, which has correlation with the severity of ocular and nasal symptoms.

In addition, multiple prospective clinical studies show that MFNS therapy significantly improves nasal symptoms, QoL, sleep quality and upper airway condition in patients with AR[22].

Mometasone furoate is both safe and effective. Mometasone furoate is efficient on all types of sensitizations. In one study performed in Beijing, Artemisia pollen was the main allergen and the treatment with intranasal steroids was effective to pollinosis[21]. This treatment was proven to ameliorate symptoms and help also pollinosis to Japanese cedar/cypress pollinosis (JCCP)[23].

Therapeutic response using topical intranasal mometasone furoate for the therapy of persistent, moderate to severe allergic rhinitis is proven by the decrease in inflammatory cells in the nasal mucosa[24, 25].

In refractory cases, the combined use of an intranasal corticosteroid and an oral antihistamine may determine a significant improvement in nasal and ocular symptom scores.

In persistent, moderate to severe AR, rhinocytograms show significantly increased number of mast cells, lymphocytes or plasma cells.

Nasal cytology should be performed for routine, as an office procedure, for a better diagnosis for primary care physicians and follow-up of nasal disorders. Setting a rational therapeutic approach is fundamental, in order to prevent the possible complications and to improve the patients' quality of life.

Nasal cytology is easy to perform and it is able to indicate the necessity of anti-inflammatory treatments, as intranasal corticosteroids and subcutaneous/sublingual allergen immunotherapy, according to the data provided.

CONCLUSIONS

The use of mometasone furoate determines a significant improvement in allergic rhinitis symptoms, being efficacious in the treatment of AR in adults and showing a good safety profile. Mometasone furoate is efficient on all types of sensitizations and on all symptoms (ocular, nasal obstruction, rhinorrhea, sneezing and nasal itching). Patients allergic to Ambrosia have ocular symptoms poorly controlled by topical steroids; in addition, they need supplementary therapy before and during the season.

Symptom scoring systems are widely used for the evaluation of drug efficacy in allergic rhinitis treatment. When investigating the disease and evaluating treatment efficacy, objective as well as subjective methods are needed. The nasal cytological assessment is a simple, objective method, which provides valuable information about the nasal mucosa.

The use of intranasal corticosteroids is associated with a decrease in the inflammatory cells number noticed on nasal cytology. These findings suggest that the therapeutic benefits of topical intranasal mometasone in the management of persistent allergic rhinitis are reflected by the decrease in cells in the nasal mucosa.

INS are the recommended first-line therapy for all patients with AR that is greater than mild intermittent in severity.

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