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Treatment Outcomes in Allergic Rhinitis: Nasal Obstruction Symptom Evaluation Scale-Based Analysis

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ABSTRACT

Objective: This study aimed to assess the impact of oral antihistamines (OAH), intranasal corticosteroids (INC), and their combination on Nasal Obstruction Symptom Evaluation (NOSE) scores in individuals diagnosed with mild persistent allergic rhinitis.

Materials and Methods: This retrospective study analyzed medical records of 86 patients with mild persistent allergic rhinitis. Patients had been treated with OAH, INC, or combination of both, and symptom severity was assessed using the NOSE scale – an instrument specifically measuring nasal obstruction – before treatment and at one month post-treatment.

Results: A total of 86 patients were included, with similar distributions of age (33 [18-79]) and gender (48% female) among the treatment groups. Patients treated with INC exhibited a more pronounced reduction in nasal obstruction symptoms. Multiple linear regression analysis indicated that the baseline NOSE score was the only significant predictor of post-treatment outcomes (β=0.434, $p<0.0001$), whereas age, gender, and treatment type did not demonstrate statistical significance.

Conclusion: These findings indicate that adding OAHs to INC therapy does not enhance the relief of nasal obstruction in patients with mild persistent allergic rhinitis. Given their proven efficacy and safety, INCs alone may be sufficient and should be considered the first-line treatment for managing nasal obstruction in this patient cohort. However, given the multisystemic symptoms of allergic rhinitis, and the limits of NOSE scale to evaluate symptoms other than nasal airway obstruction, the results of this study should be interpreted carefully. Future studies utilizing multisystem scoring systems are required to capture the broader clinical effects of treatment.

Keywords: Intranasal corticosteroid, mild persistent, nasal obstruction, nose scale, rhinitis

INTRODUCTION

Allergic rhinitis is characterized by inflammation of the mucous membranes of the nose, triggered by exposure to allergens in the air. The typical symptoms associated with this condition include rhinorrhea, nasal congestion, sneezing and itching, which are initiated by the triggering of an IgE-mediated type 1 hypersensitivity reaction within the immune system. Additionally, it may manifest with ocular manifestations. Non-specific symptoms encompass generalized illness, malaise, and fatigue (1, 2). This condition may also impact work productivity by impairing overall well-being; as well as increase drug costs, and create a socioeconomic burden (3). The severity of allergic rhinitis is classified based on the criteria outlined in the Allergic Rhinitis and its Impact on Asthma (ARIA) guideline as mild and moderate/severe, as well as persistent and intermittent (4, 5). Persistent means that symptoms persist for at least four days in a week or four weeks in a year. The therapeutic concerns are allergen prevention strategies, pharmacotherapy, and immunotherapy. Pharmacological treatments include intranasal corticosteroids (INC), intranasal antihistamines, oral antihistamines (OAH), combinations of corticosteroids and antihistamines, leukotriene

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receptor antagonists or combinations, and anticholinergics. For the treatment of mild persistent allergic rhinitis, antihistamines, INC, or their combination is recommended, with a re-evaluation after 2–4 weeks (4, 6).

Nasal obstruction is widely regarded as one of the most bothersome symptom of allergic rhinitis (7). Although reliable objective methods for evaluating nasal function have been developed, the relationship between objective assessments and patients' subjective symptoms is still unreliable (8). The Nasal Obstruction Symptom Evaluation (NOSE) scale is a reliable tool for assessing nasal obstruction and measuring outcomes in nasal disorders (9). This method has been utilized to evaluate the improvement in nasal obstruction (10). We hypothesized that different treatment modalities would lead to varying degrees of improvement in nasal obstruction, as measured by the NOSE scale, in patients with mild persistent allergic rhinitis. The present study was conceived with the objective of evaluating the NOSE score in three distinct treatment groups receiving OAH, INC, and a combination of OAH+INC in mild persistent allergic rhinitis. The primary objective was to compare changes in NOSE scores among these groups, while the secondary objective was to assess the relative effectiveness of each treatment in alleviating nasal obstruction symptoms based on pre- and post-treatment evaluations.

MATERIALS and METHODS

Ethical Approval and Study Design

This study was conducted retrospectively with prior approval from the relevant local research ethics committee (approval number: 2021/108). Written informed consent was obtained from all participants.

Patient Selection and Clinical Evaluation

A total of 1,920 patients with a new diagnosis of persistent allergic rhinitis were identified between January 1, 2024, and January 1, 2025 (Figure 1). As illustrated in the STROBE flow diagram, application of our strict inclusion and exclusion criteria (summarized below and detailed in

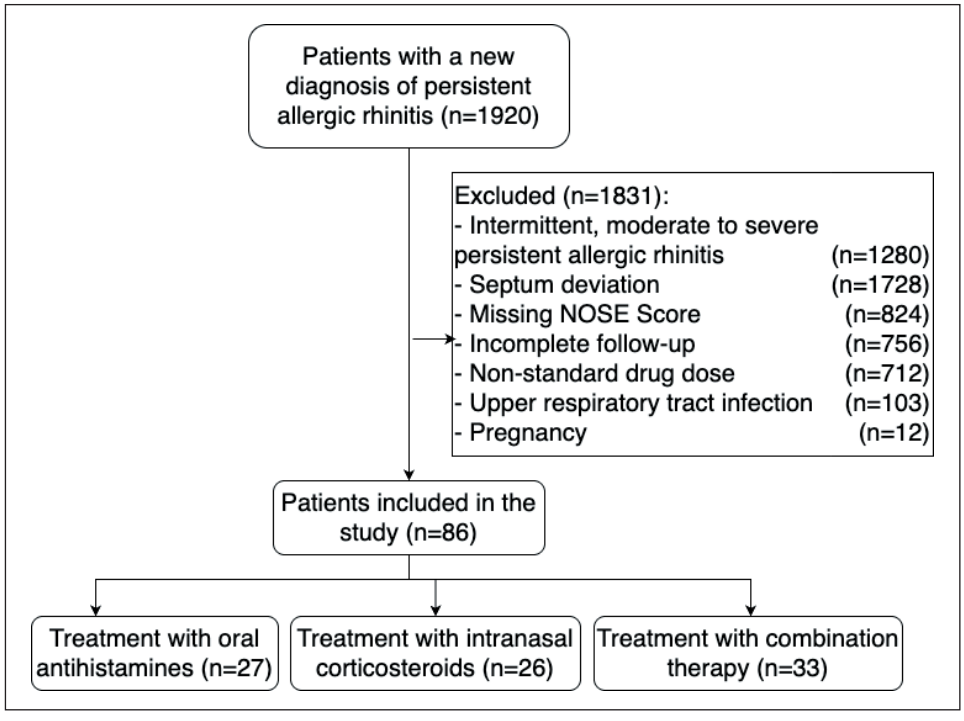

Figure 1: STROBE flow diagram of patient inclusion and exclusion. Of the 1,920 patients with a new diagnosis of persistent allergic rhinitis, 1,831 were excluded for intermittent, moderate-to-severe disease (n = 1,280), septal deviation (n = 1,728), missing NOSE score (n = 824), incomplete follow-up (n = 756), non-standard drug dosing (n = 712), concurrent upper respiratory tract infection (n = 103), or pregnancy (n = 12), yielding 86 patients for analysis (oral antihistamines, n = 27; intranasal corticosteroids, n = 26; combination therapy, n = 33).

NOSE: *Nasal Obstruction Symptom Evaluation.*

Figure 1) yielded 86 patients with mild persistent allergic rhinitis who had complete baseline and one-month post-treatment NOSE scores. Allergic rhinitis and its severity were classified retrospectively according to the ARIA guidelines: mild persistent disease was defined as symptoms on ≥4 days/week or ≥4 weeks/year, without significant sleep disturbance or impairment in daily activities (4, 6). Diagnosis was made by history and physical exam documented by a single otolaryngologist; objective allergy testing (skin-prick or serum-specific IgE) and airflow measurements were not routinely available. All included patients were ≥ 18 years old, treated by a single otolaryngologist with standardized OAH and/or INC regimens, and demonstrated full adherence and follow-up. Data including self-reported adverse events were retrieved retrospectively from our electronic medical record system.

Exclusion Criteria

Patients were excluded for any of the following: intermittent or moderate-to-severe persistent allergic rhinitis, upper respiratory tract infection, deviated septum, sinonasal mass, septal perforation, septal synechiae, structural inferior turbinate hypertrophy, chronic sinusitis, mental retardation, adenoid hypertrophy, intermittent and moderate to severe persistent allergic rhinitis, asthma, or pregnancy.

Patient Groups and Treatment Protocol

Patients were classified into three groups based on the treatment they received:

OAH monotherapy: Patients treated with bilastine 20 mg/day.

INC monotherapy: Patients treated with beclomethasone dipropionate administered as two sprays per nostril once daily, 100 μg per spray.

OAH+INC combination: Patients treated with beclomethasone dipropionate as above plus bilastine 20 mg/day.

Due to the retrospective nature of the study, the drug types and dosages were not predetermined; they were rather determined by the clinical judgment of the attending physician in accordance with established clinical guidelines. To standardize drug types and dosages, only patients who received the abovementioned drug types and dosages were included.

Symptom Assessment

The NOSE scale was used to assess the severity of nasal obstruction symptoms. This validated instrument consists of five questions addressing nasal obstruction and its impact on the patient's daily life:

1. Nasal congestion or stuffiness
2. Nasal blockage or obstruction
3. Trouble breathing through the nose
4. Trouble sleeping
5. Being unable to get enough air through the nose during exercise or exertion

Each item is scored on a five-point Likert scale according to symptom severity: 0 = absent, 1 = minimal, 2 = mild, 3 = moderate, 4 = severe. The total score ranges from 0 to 20 and can optionally be multiplied by 5 to yield a normalized score ranging from 0 to 100. In this study, patients were evaluated using the NOSE scale both before treatment and again one month after treatment to assess changes in nasal obstruction symptoms. The Turkish version of the scale has been previously validated for reliability and accuracy (11, 12). At the follow-up visit after the one-month treatment period, patients reported consistent adherence to the prescribed medication regimen. However, treatment adherence was based solely on patient self-report and was not objectively verified.

Primary Outcome Measure

The primary outcome measure was defined as the change in NOSE scores from baseline (pre-treatment) to the 1-month follow-up (post-treatment), with a greater reduction indicating more effective symptom relief.

Statistical Analysis

The appropriate sample size was determined by a priori power analysis using G*Power software (version 3.1). Based on prior studies assessing changes in nasal symptom scores following INC therapy, the primary outcome was expected to demonstrate a moderate magnitude of effect, with Cohen's f estimated at 0.35. A total of 84 participants (28 per group) was required to achieve 80% power at a significance level of 0.05.

Table I: Patient Demographic and Clinical Characteristics. Data were expressed as n (%) for categorical variables, and median (IQR [range]) for continuous variables.

Characteristic	OAH monotherapy (n=27)	INC monotherapy (n=26)	OAH+INC combination (n=33)	p-value
Age, years	33 (27.5-56)	35.5 (28.3-44)	33 (29-49)	0.843*
Female gender, n (%)	13 (48)	12 (46)	16 (48.5)	0.915**
Baseline NOSE Score	9 (7-11)	10 (7-13)	11 (9-14)	0.076*
Post-treatment NOSE Score	6 (3-9.5)	3 (2-6)	6 (4-9)	0.035*,***

OAH: Oral antihistamine, **INC:** Intranasal corticosteroids.

* Kruskal–Wallis test for median differences

** Chi-square test for proportions

*** Post-hoc comparison was performed with Wilcoxon test. Median score in INC monotherapy is lower compared to OAH monotherapy (3, 95% CI: 1.99 - 4); Median score in INC monotherapy is lower compared to the OAH+INC combination (3, 95% CI: 2.99 - 3.99).

Statistical analyses were performed using the R software (version 4.1.2, R Foundation for Statistical Computing, Vienna, Austria). Normality of continuous variables was tested with the Shapiro-Wilk test. Continuous variables were expressed as mean ± standard deviation if normally distributed, or as median (interquartile) otherwise. Categorical data were expressed as count (percentage%) and compared with chi-square test. The NOSE scores of three groups were compared with one-way ANOVA. Pairwise comparisons were done with the paired t-test (adjusted with the Bonferroni method). To adjust for baseline differences, an analysis of covariance (ANCOVA) was conducted with pre-treatment NOSE scores as a covariate. Factors associated with post-treatment NOSE scores were evaluated using a multiple linear regression model, incorporating age, gender, baseline NOSE scores, and treatment group as independent variables. To ensure model validity, residual diagnostics were performed, and variance inflation factors were analyzed for multicollinearity. A p-value <0.05 was considered significant.

RESULTS

A total of 86 participants were enrolled in the study, including 41 females and 45 males. Baseline demographics—age, sex, and initial NOSE score—were similar across all three treatment arms (Table I), indicating comparability at study entry. The mean age was 38 years, with most participants ranging from 28 to 52 years. At the 1-month follow-up, no patients reported experiencing adverse effects from the prescribed treatments. The distribution across study groups was as follows: 27 patients in OAH monotherapy, 26 in INC monotherapy, and 33 in the OAH+INC combination. There were no statistically significant differences among the groups regarding age or gender.

Table II: Summary table of the regression model.

Predictor	Estimate	Std. Error	t-value	p-value
Intercept	0.722	2.202	0.328	0.744
Baseline NOSE score	0.434	0.116	3.735	<0.0001*
Age	0.006	0.031	0.204	0.839
Gender	-0.534	0.871	-0.613	0.542
Treatment type	0.595	0.534	1.115	0.268

* $F = 4.429$, $p = 0.0027$, Adjusted $R^2 = 0.1389$

To control for potential confounders, a regression model was applied, incorporating baseline NOSE scores, age, and gender as covariates. The treatment group served as the primary predictor, while the post-treatment NOSE score was set as the outcome variable. Patients receiving OAH monotherapy served as the reference group. The regression analysis yielded statistically significant results, explaining approximately 18% of the variability in post-treatment NOSE scores.

After adjusting for baseline differences, only the pre-treatment NOSE score significantly predicted post-treatment outcomes. A 1-point higher baseline NOSE predicts a 0.434-point higher post-treatment NOSE value, suggesting that patients starting with more severe obstruction derive proportionally less benefit. In contrast, neither age, gender, nor treatment type reached statistical significance (Table II).

The NOSE score obtained following the application of the respective treatment, in addition to the difference from the pre-treatment value, is presented in Table I. Figure 2 depicts pre- and post-treatment NOSE scores for each arm. In OAH monotherapy, median NOSE fell from

9 (IQR 7–11) to 6 (IQR 3–10), Δ = –3 points (p = 0.15). In INC monotherapy, median NOSE fell from 10 (IQR 7–13) to 3 (IQR 2–6), Δ = –7 points (p< 0.01). In the OAH+INC combination, median NOSE fell from 11 (IQR 9–14) to 6 (IQR 4–9), Δ = –5 points (p = 0.02). Although both INC monotherapy and OAH+INC combination achieved similar absolute reductions, the INC monotherapy showed a numerically greater proportion of responders—5 patients (19.1%) in the INC group achieved a ≥10-point drop compared to 4 patients (12.1%) in the OAH+INC combination and 2 patients (7.4%) in the OAH monotherapy groups (Figure 2). Consequently, INC treatment was found to be associated with lower post-treatment scores.

DISCUSSION

The current study showed that treatment with INC monotherapy resulted in a more pronounced improvement in nasal obstruction symptoms than OAH monotherapy or a combination. Although Figure 2 demonstrates that the INC+OAH combination produces a median NOSE-score reduction equivalent to INC monotherapy, the proportion of robust responders (≥10-point drop) was lower. In our multivariable ANCOVA (adjusting for baseline NOSE, age, and gender), the treatment group itself did not significantly predict post-treatment NOSE (β = 0.595, 95% CI [–0.450 to 1.640], p = 0.2679). Both of these results underscores that adding OAH to INC does not confer additional benefit on nasal obstruction scores.

Consistent with the findings reported in the literature, INC proved to be an effective treatment for allergic rhinitis, leading to a significant reduction in NOSE scores and considerable improvement in nasal obstruction symptoms. In this cohort, baseline NOSE scores correlated strongly with post-treatment improvement (β=0.434), indicating that subjective obstruction reliably tracked therapeutic response in mild disease. Clinically, this means that for each one-point higher NOSE score at baseline, patients on average end up only 0.43 points higher at one month, reflect-

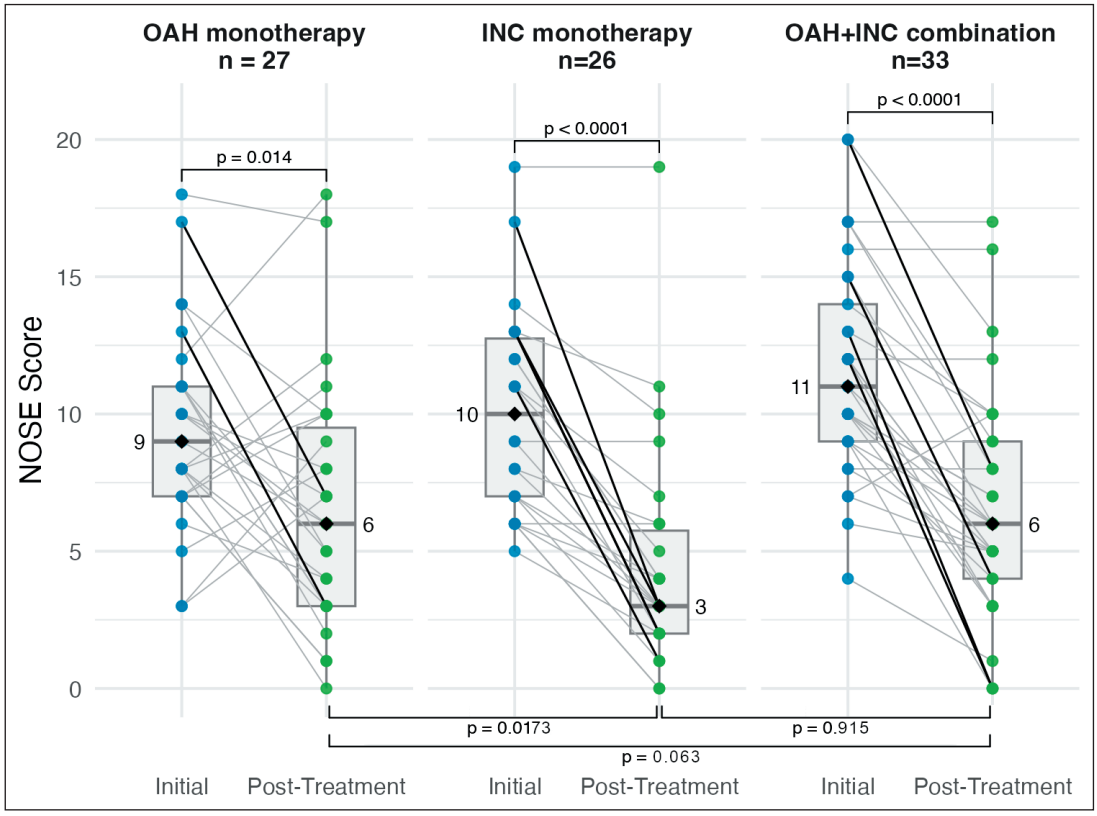

Figure 2: Comparison of initial and post-treatment NOSE scores among treatment groups. Boxes represent the distribution of NOSE scores; lines indicate individual patient score changes. p-values on top of the plot indicate within-group comparisons; p-values on the bottom of the plot indicate between-group comparisons of post-treatment NOSE Scores.

OAH: *Oral antihistamine,* ***INC:*** *Intranasal corticosteroid.*

ing a proportionally greater absolute improvement among those who started with worse obstruction. In practice, a patient with a 10-point baseline NOSE can expect roughly a 4.3-point residual score—versus a 2.2-point residual for someone starting at 5—underscoring that individuals with more severe symptoms still achieve meaningful relief. This highlights the importance of baseline symptom burden in predicting response and underlines the need for individualized assessment and expectation management, particularly for patients presenting with milder symptoms. However, the role of objective nasal airflow measurements in complementing routine clinical assessments of nasal obstruction remains uncertain. Objective measurements are rarely used in clinical practice, except as a research tool. Previous studies have shown that objective techniques such as rhinomanometry have poor agreement with clinical examination (13, 14). Welkoborsky et al. reported a significant decrease in airflow by rhinomanometry in patients with severe nasal obstruction. However, they emphasized that the correlation with rhinomanometry results was poor in patients with mild to moderate nasal obstruction on endoscopic examination (15). The NOSE scale is a practical and validated tool that offers a simple, cost-effective, and reliable means of assessing nasal obstruction symptoms. Its subjective nature makes it particularly valuable in real-world clinical settings, where quick and patient-centered evaluation of symptom burden is essential for guiding treatment decisions and monitoring outcomes (8, 10).

Allergic rhinitis is commonly managed with antihistamines, which effectively alleviate symptoms such as sneezing, rhinorrhea, and pruritus. However, their impact on nasal obstruction is limited. Antihistamines exert their effects by acting on histamine-1 receptors, primarily controlling the early-phase inflammatory response, but they have minimal influence on the late-phase inflammation. In contrast, INCs target both early- and late-phase inflammatory responses, thereby offering effective symptom control across the full spectrum of allergic rhinitis manifestations (16, 17). In this study, although a reduction in NOSE scores was noted with OAH monotherapy, the change did not reach statistical significance. This finding aligns with the existing literature, which underscores the limited impact of OAH on nasal obstruction. The superior efficacy of INC in alleviating nasal obstruction is attributed to its capacity to suppress both early- and late-phase inflammatory responses. Several randomized trials (e.g., Nielsen and Dahl; Anolik and Group MFNSWLS) have directly compared INC versus the INC+ OAH combination, consistently finding no added symptom relief from the antihistamine (18,19). Similarly, several comprehensive studies have evaluated the efficacy of combination therapy with INC and OAH compared to INC monotherapy. These studies found no additional benefit of this combination (20-22). However, these studies were not specifically conducted in patients with mild persistent allergic rhinitis, and the efficacy of these treatment strategies has not been systematically evaluated within this clinical subgroup. By providing data on this underexplored comparison in the context of mild persistent allergic rhinitis, our study contributes to filling a gap in the current literature regarding the management of nasal obstruction. Following the evaluation of the results of these meta-analyses, it was determined that the OAH+INC combination did not augment the effects of INC. A notable finding was that NOSE score reduction was greater with INC monotherapy compared to the OAH+INC combination, but this difference was not statistically significant. This finding may be attributable to the fact that mucosal dryness—a potential consequence of concomitant use of antihistamines and INCs—may become more pronounced and lead to an increased subjective sensation of nasal obstruction. Second-generation OAHs are widely used to treat allergic rhinitis due to their lower anticholinergic side effect profile compared to first-generation agents. However, mild adverse effects such as headache, drowsiness, fatigue, nausea, mucosal dryness may still be encountered. Similarly, sustained INC treatment may result in local side effects, including nasal discomfort, mild epistaxis, dryness, and, in rare instances, septal perforation due to mucosal irritation. The combined use of these medications may further contribute to nasal mucosal dryness as a side effect (23, 24).

A meta-analysis was conducted to compare the efficacy of OAH and INC in the treatment of allergic rhinitis. The findings indicated that nasal steroids provided greater symptom relief, particularly with respect to nasal congestion, sneezing, rhinorrhea, and pruritus (25). The findings of this study indicated that INC exhibited greater efficacy than OAH, as supported by our results. Furthermore, when the two groups were appraised in terms of their impact on the quality of life, INCs were found to be superior (26). Some studies found no substantial disparities between the two groups with regard to ocular symptoms (27, 28). A paucity of studies has been published which evaluate the efficacy of combined OAH and INC in comparison with OAH monotherapy. This study contrib-

utes to the field by filling this gap through a direct comparison of these two treatment approaches. The enhanced effectiveness of INC in managing allergic rhinitis relative to OAH can be ascribed to the prevalence of late-phase inflammatory mediators. In patients exhibiting protracted symptoms, histamine elicits a comparatively negligible response (29). As has been demonstrated, the involvement of cytokines and chemokines is a hallmark of the late-stage reaction, which in turn induces eosinophil chemotaxis. This process is known to result in nasal irritation and mucus secretion (30). The potential of INC, a pharmaceutical agent that has been demonstrated to directly suppress nasal inflammation, to offer a more efficacious treatment option in comparison to drugs that only possess antihistamine effects is hypothesized (31). Furthermore, INCs have been demonstrated to exhibit minimal systemic bioavailability and absorption through the respiratory and digestive mucosa, in addition to not generally suppressing the hypothalamic-pituitary-adrenal axis (32, 33).

In this study, only the symptom scores were utilized as clinical assessment methods, and objective assessment methods (e.g. rhinomanometry and acoustic rhinometry) were not used. Furthermore, the lack of objective clinical assessments for diagnosing allergic rhinitis, including confirmatory tests such as skin prick tests or serum-specific IgE measurements, the retrospective design of the study, and the small sample size constitute limitations of this research.

Additionally, symptom severity was assessed solely by the NOSE scale, which specifically evaluates nasal obstruction but does not capture the full spectrum of allergic rhinitis symptoms such as sneezing, nasal itching, rhinorrhea, and ocular complaints. Consequently, only nasal obstruction was assessed, while other core symptoms of allergic rhinitis were not evaluated, limiting the comprehensive assessment of symptom burden and treatment response. Moreover, although practical and widely used for nasal obstruction, the NOSE scale has not been specifically validated for allergic rhinitis and therefore may not fully reflect the complexity of this condition (34, 35). Another limitation is the absence of a treatment group receiving a combination of INCs and intranasal antihistamines. Including such a group could have provided additional insight into potential synergistic effects of local combination therapy, which is increasingly relevant in clinical practice. Future studies should consider incorporating more comprehensive multisymptom assessment tools, such as the Total Nasal Symptom Score (TNSS) or the Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ), to better evaluate treatment effects across all symptom domains.

The optimal pharmacological treatment is determined by balancing maximal symptom relief with minimal risk of side effects. All patients were asked about side effects at follow-up, and none were reported. However, prospective studies with systematic adverse event monitoring are warranted to better define the risk-benefit profile of different treatment approaches. A priori power analysis indicated that at least 28 patients per group were required to detect significant differences with 80% power. A post-hoc power calculation based on the observed treatment effect ($t = 1.115$, $df = 81$) shows that this study was underpowered (28%) to detect small effect sizes. In contrast, for a typical medium effect size, the same design would exceed 80% power. Thus, while our sample was sufficient for moderate effects, it lacked power for the smaller effect actually seen. A prospective study with a larger sample size would yield more robust evidence and enhance the validation of these findings.

CONCLUSION

Current evidence indicates that OAHs have minimal impact on nasal obstruction. This study provides evidence that INC monotherapy leads to greater improvement in nasal obstruction symptoms compared to OAH monotherapy or a combination in patients with mild persistent allergic rhinitis. Given their proven efficacy and safety profile, INC monotherapy appears to be the preferred option, offering advantages in both patient compliance and cost-effectiveness.

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Conflict of Interest

The authors declare no conflict of interest.

Financial Disclosure

No financial support or funding was used in this study.

Ethical Approval

This study was conducted retrospectively with prior approval from the relevant local research ethics committee (approval number: 2021/108). Written informed consent was obtained from all participants.

Author Contributions

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