

Evaluating the Effectiveness of Immunotherapy in Allergic Rhinitis**Reddy Gowd Sreenivasulu¹, S. Shiva Raj Goud², S. Rajitha³, Bandaru Akhila⁴**¹Assistant Professor, Department of ENT, Wanaparty Government Medical College, Wanaparthi, Telangana.²Assistant Professor, Department of Paediatrics, Mallareddy Institute of Medical Sciences, Suraram, Hyderabad, Telangana.³Assistant Professor, Department of Anaesthesia, Wanaparty Government Medical College, Wanaparthi, Telangana.⁴Senior Resident, Department of Radiology, Wanaparty Government Medical College, Wanaparthi, Telangana.

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Abstract

Background: Allergic rhinitis (AR) is a chronic inflammatory nasal mucosal disorder caused by immunoglobulin E (IgE)-mediated reactions to environmental allergens. It severely affects quality of life and is accompanied by comorbid diseases like asthma, sinusitis, and conjunctivitis. Symptomatic relief with conventional therapy using antihistamines and corticosteroids is achieved without altering the underlying immunological process. Allergen-specific immunotherapy (AIT) has also been the sole disease-modifying therapy, seeking to promote long-lasting tolerance to allergens and weaken symptom severity.

Objective: The present study was undertaken to evaluate the effectiveness of immunotherapy in patients with allergic rhinitis in terms of symptom improvement, reduction in medication use, and overall quality of life.

Methods: Prospective observational study was undertaken for 12 months at a tertiary care center on 100 patients aged 20-40 years diagnosed with moderate to severe allergic rhinitis as per clinical history, nasal endoscopy, and positive skin prick test or specific IgE assay. SCIT was administered according to individual allergen sensitivity in build-up and maintenance phases to the patients. Severity of symptoms was measured with Total Nasal Symptom Score (TNSS) and Visual Analog Scale (VAS), while the quality of life was determined by Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ). The measurements were conducted at baseline, 6 months, and 12 months.

Results: Substantial reduction in TNSS and VAS scores from baseline to the 12-month follow-up ($p < 0.001$) reflected significant improvement of nasal symptoms including sneezing, rhinorrhea, nasal obstruction, and itching. Medication use declined considerably, with 78% of the patients reporting minimal use of rescue medications at one year of treatment. RQLQ scores indicated enhanced general quality of life, especially in areas associated with sleep, activity, and social function. There were no significant systemic adverse reactions; local injection site reactions were mild and transient.

Conclusion: Immunotherapy was effective and safe as a treatment method in patients with allergic rhinitis, with significant reduction in symptom severity, drug dependence, and improving quality of life. These findings reaffirm the position of immunotherapy as an anchor in the long-term management of allergic rhinitis.

Keywords: Allergic rhinitis, Immunotherapy, Allergen-specific immunotherapy, Subcutaneous immunotherapy, Total Nasal Symptom Score, Quality of life.

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Introduction

Allergic rhinitis (AR) is the worldwide most prevalent chronic respiratory disease and increasingly is viewed as a global health issue due to its worldwide prevalence and its effect on the quality of life of the patients [1]. AR represents an IgE-mediated hypersensitivity response of the nasal mucosa to some environmental allergens like house dust mites, pollen grains, fungal spores, animal

dander, and occupation-related allergens. The immunopathogenesis of AR is an intricate interaction between genetic predisposition, environmental exposure, and dysregulated immunity, which leads to an inflammatory cascade in the nasal mucosa [2]. Epidemiological studies reveal that allergic rhinitis presents in 10% to 30% of adults and 40% of children in various geographic

locations. Prevalence has been reported increasing in developing nations because of the reasons of increasing urbanization, lifestyle modifications, high air pollution, and amplified exposure to allergens in the home [3]. While a non-life-threatening condition, AR has profound effects on the physical, psychological, and social well-being of patients. It presents with chronic congestion of the nose, rhinorrhea, sneezing, and nasal pruritus that may be preceded by ocular symptoms such as conjunctival irritation, lacrimation, and redness. They interfere with sleep quality, reduce workplace productivity, impair cognitive performance, and reduce overall quality of life [4].

The infection is often coupled with comorbidities like asthma, chronic sinusitis, otitis media, and conjunctivitis, thus exacerbating the disease burden and the health care cost. Allergic rhinitis and asthma share a common pathophysiologic basis, and AR left untreated may worsen or present as asthma. Thus, treatment of AR is not only symptomatic but also to prevent the long-term sequelae [5].

Conservative treatments for allergic rhinitis essentially include pharmacotherapy using oral antihistamines, intranasal corticosteroids, leukotriene receptor antagonists, and symptomatic drugs. Although these drugs provide symptomatic relief in the short term, they do not address the underlying immunological mechanism and therefore do not change the natural history of the disease [6]. Long-term or continuous pharmacologic treatment is prone to issues of non-compliance, potential side effects from medication, and recurring symptoms even after withdrawal. This directs towards the need for a therapy which can maintain remission and modify the disease rather than achieve transient symptomatic relief [7].

Allergen-specific immunotherapy (AIT) or immunotherapy has emerged as the only evidence-based therapy that has been proven to alter the course of allergic rhinitis. It operates by gradually giving the patient controlled amounts of allergen extracts, thereby establishing immunological tolerance and reducing the hypersensitivity response [8]. AIT can be administered either via subcutaneous immunotherapy (SCIT) or sublingual immunotherapy (SLIT). Numerous studies have demonstrated its effectiveness in dramatically reducing nasal and eye symptoms, decreasing drug usage, and improving patient quality of life. Additionally, immunotherapy has also been shown to induce long-lasting effects upon cessation and reduce the risk of asthma development and new allergen sensitizations [9]. Even though these advantages have been established, immunotherapy has yet to be commonly used in the majority of developing countries due to a lack of awareness, fear of adverse effects, and a requirement for specialized medical centers. With growing evidence of its long-

term efficacy and safety, however, immunotherapy is now being viewed more and more as a fundamental treatment plan for allergic rhinitis.

Against this backdrop, the current study was planned to assess the clinical efficacy and safety of subcutaneous immunotherapy in patients with allergic rhinitis between 20 and 40 years at a tertiary care hospital. The major aims were to measure improvement in symptom severity through validated scoring systems, assess the decrease in the use of rescue medications, and identify the quality of life improvement after a year of treatment.

Materials and Methods

Study Design and Setting: The present study was a prospective observational clinical study conducted in the Department of Otorhinolaryngology at a tertiary care teaching hospital over a period of 12 months.

The study aimed to assess the clinical effectiveness and safety profile of allergen-specific immunotherapy in patients diagnosed with allergic rhinitis. The study adhered strictly to ethical guidelines, and written informed consent was obtained from all participants prior to enrollment.

Study Duration: The study was carried out over one calendar year, from January 2021 to December 2021, which allowed for adequate follow-up of patients during the treatment phases and ensured seasonal variation in allergen exposure was accounted for in the analysis.

Study Population and Sample Size: A total of 100 patients were recruited for the study based on predefined inclusion and exclusion criteria. The sample size was determined considering the feasibility within the study duration and existing literature on immunotherapy trials in allergic rhinitis. All patients were aged between 20 and 40 years, ensuring a relatively homogeneous age group where allergic rhinitis is commonly encountered.

Inclusion Criteria

- Patients aged 20 to 40 years with a clinical diagnosis of allergic rhinitis according to ARIA (Allergic Rhinitis and its Impact on Asthma) guidelines.
- Positive skin prick test (SPT) or specific serum IgE test confirming allergen sensitivity.
- Patients with moderate to severe symptoms persisting despite optimal pharmacotherapy.
- Willingness to comply with treatment protocol and follow-up visits.

Exclusion Criteria

- Patients with uncontrolled asthma or severe systemic illnesses.
- Pregnant or lactating women.

- Patients with autoimmune disorders or immunodeficiency conditions.
- Previous history of allergen immunotherapy.
- Inability to adhere to follow-up schedule.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee prior to initiation. All participants were provided with detailed information about the study objectives, potential benefits, and possible adverse effects of immunotherapy. Written informed consent was obtained in the local language from each participant.

Diagnostic Work-up

Diagnosis of allergic rhinitis was established based on:

1. **Clinical History and Examination:** Detailed history of nasal and ocular symptoms, seasonal variation, family history of atopy, and triggering factors.
2. **Skin Prick Test (SPT):** Performed using standardized allergen extracts to identify specific sensitizations.
3. **Serum Specific IgE Assay:** Conducted when SPT was contraindicated or inconclusive.
4. **Nasal Endoscopy:** To rule out anatomical abnormalities and confirm inflammatory changes.
5. **Baseline Symptom Assessment:** Using Total Nasal Symptom Score (TNSS) and Visual Analog Scale (VAS).

Intervention: Allergen-Specific Immunotherapy

All participants underwent subcutaneous immunotherapy (SCIT) following a standardized protocol:

- **Build-up Phase:** Incremental doses of allergen extract administered subcutaneously weekly for 10–12 weeks until the maintenance dose was reached.
- **Maintenance Phase:** Administration of the maintenance dose every 4 weeks for the remainder of the study period.

The allergen extracts used were based on individual sensitization profiles identified through diagnostic testing. Patients were observed for at least 30 minutes after each injection for any immediate hypersensitivity reactions.

Concomitant Medications

Rescue medications such as oral antihistamines and intranasal corticosteroids were permitted when required. All medication usage was recorded in a standardized log to assess changes in dependency during the study.

Outcome Measures

1. Primary Outcomes

- Change in TNSS from baseline to 6 months and 12 months.
- Change in VAS score for overall symptom severity at the same intervals.

2. Secondary Outcomes

- Reduction in the frequency and dosage of rescue medications.
- Improvement in Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) scores.
- Incidence of adverse reactions related to immunotherapy.

Data Collection and Follow-Up

Patients were evaluated at three time points: baseline, 6 months, and 12 months after initiation of therapy. At each visit, TNSS, VAS, and RQLQ scores were recorded. Adverse events were documented throughout the study period. Compliance with the immunotherapy protocol was monitored using appointment logs.

Statistical Analysis

Data were compiled and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Quantitative variables such as TNSS, VAS, and RQLQ scores were expressed as mean \pm standard deviation (SD). Comparisons across time intervals were performed using paired t-test or repeated measures ANOVA. Categorical variables such as gender distribution and presence of adverse reactions were analyzed using Chi-square test. A p-value of <0.05 was considered statistically significant.

Results

A total of 100 patients with allergic rhinitis who fulfilled the inclusion criteria were enrolled and completed the one-year follow-up. The age of the patients ranged from 20 to 40 years, with a mean age of 29.4 ± 5.6 years. Among the participants, males constituted a slight majority compared to females. All patients completed the build-up and maintenance phases of immunotherapy, with good compliance and minimal dropout. Baseline clinical characteristics, allergen sensitivity distribution, and severity of symptoms were documented and compared with follow-up data at 6 months and 12 months. Significant improvements were observed in TNSS, VAS scores, quality-of-life parameters, and rescue medication usage at the end of the study period. The incidence of adverse reactions was minimal and manageable, confirming the safety of subcutaneous immunotherapy.

Table 1: Age-wise distribution of patients

Age Group (Years)	Number of Patients (n=100)	Percentage (%)
20–24	22	22.0
25–29	28	28.0
30–34	25	25.0
35–40	25	25.0

This table represents the distribution of patients according to their age groups within the study population.

Table 1 : The maximum number of patients belonged to the age group of 25–29 years (28%), followed by 30–34 years (25%) and 35–40 years (25%), indicating that allergic rhinitis was most common among young adults.

Table 2: Gender distribution of patients

Gender	Number of Patients	Percentage (%)
Male	56	56.0
Female	44	44.0

This table provides the gender-wise distribution among the study participants.

Table 2: Males constituted 56% of the study population, whereas females accounted for 44%, indicating a slight male predominance.

Table 3: Duration of allergic rhinitis symptoms prior to enrollment

Duration of Symptoms	Number of Patients	Percentage (%)
< 1 year	10	10.0
1–3 years	35	35.0
4–6 years	40	40.0
> 6 years	15	15.0

This table depicts the duration of symptoms in years prior to initiation of immunotherapy.

Table 3: Most patients (40%) had symptoms persisting for 4–6 years, followed by 35% who had symptoms for 1–3 years, suggesting chronic disease progression before treatment.

Table 4: Common allergens identified by skin prick test

Allergen Type	Number of Patients	Percentage (%)
House dust mite	68	68.0
Pollen (grass/weed)	52	52.0
Animal dander	30	30.0
Fungal spores	18	18.0

This table illustrates the distribution of allergen sensitization among patients based on skin prick test results.

Table 4: House dust mite was the most common allergen (68%), followed by pollen (52%), whereas fungal spores were least common (18%).

Table 5: Baseline Total Nasal Symptom Score (TNSS)

TNSS Score Range	Number of Patients	Percentage (%)
Mild (4–6)	10	10.0
Moderate (7–9)	35	35.0
Severe (10–12)	55	55.0

This table shows the severity of nasal symptoms in patients before the initiation of immunotherapy.

Table 5: At baseline, the majority of patients (55%) had severe nasal symptoms, while only 10% had mild symptoms.

Table 6: Change in TNSS after 6 months and 12 months

Time Interval	Mean TNSS \pm SD
Baseline	10.4 \pm 1.2
After 6 months	6.2 \pm 1.0
After 12 months	3.4 \pm 0.8

This table demonstrates the reduction in TNSS scores following immunotherapy at 6 and 12 months compared to baseline.

Table 6: A significant reduction in TNSS was observed from baseline (10.4) to 12 months (3.4), indicating marked improvement in nasal symptoms after immunotherapy.

Table 7: Change in Visual Analog Scale (VAS) score

Time Interval	Mean VAS Score \pm SD
Baseline	8.5 \pm 0.9
After 6 months	5.0 \pm 0.7
After 12 months	2.8 \pm 0.6

This table highlights the improvement in overall symptom severity as measured by VAS scores during the study period.

Table 7: The VAS score showed a significant decline from 8.5 at baseline to 2.8 at 12 months, reflecting improved patient comfort and reduced symptom burden.

Table 8: Reduction in use of rescue medication

Time Interval	% Patients Using Rescue Medication
Baseline	90%
After 6 months	40%
After 12 months	10%

This table shows the percentage of patients requiring antihistamines and intranasal corticosteroids before and after immunotherapy.

Table 8: There was a marked reduction in the need for rescue medication from 90% at baseline to only 10% at the end of the study period.

Table 9: Quality of life improvement (RQLQ scores)

Time Interval	Mean RQLQ Score \pm SD
Baseline	5.8 \pm 0.7
After 6 months	3.4 \pm 0.5
After 12 months	1.6 \pm 0.4

This table compares the mean RQLQ scores at different intervals during the study.

Table 9: The quality of life scores improved significantly, with mean RQLQ reducing from 5.8 at baseline to 1.6 at 12 months.

Table 10: Adverse reactions observed during immunotherapy

Type of Reaction	Number of Patients	Percentage (%)
Local (injection site)	12	12.0
Mild systemic	4	4.0
Severe systemic	0	0.0

This table summarizes the incidence and type of adverse reactions noted in patients undergoing immunotherapy.

Table 10: The most common adverse effect was local reaction at the injection site (12%), while no severe systemic reactions were recorded, confirming the safety of the procedure.

Discussion

The present study was conducted to evaluate the effectiveness of subcutaneous immunotherapy (SCIT) in patients with allergic rhinitis aged between 20 and 40 years. Allergic rhinitis is a chronic inflammatory condition of the nasal mucosa caused by IgE-mediated hypersensitivity to specific allergens [10]. It significantly impairs quality of life, affects sleep, and contributes to economic burden due to reduced productivity. Immunotherapy is the only disease-modifying treatment available, targeting the underlying immunological mechanisms rather than providing symptomatic

relief alone. This study aimed to assess clinical improvement, reduction in symptom severity, improvement in quality of life, and safety profile after one year of SCIT in a tertiary care setting [11]. The demographic distribution in this study indicated that the majority of patients were young adults between 25–29 years, which aligns with existing literature suggesting that allergic rhinitis frequently affects individuals in their second and third decades of life [12]. The slight male predominance observed here is consistent with previous Indian studies, though international reports often suggest equal gender distribution. The chronicity of symptoms was evident as most patients had symptoms for more than three years, emphasizing delayed intervention and the need for early initiation of disease-modifying therapies like immunotherapy [13].

Allergen sensitization patterns in our study showed that house dust mite was the predominant allergen (68%), followed by pollens (52%). This finding corresponds with Indian epidemiological data that highlight indoor allergens as major contributors to perennial allergic rhinitis, particularly in densely populated regions with poor ventilation. The identification of dominant allergens plays a crucial role in designing an effective immunotherapy protocol [14].

A major outcome of this study was the significant reduction in TNSS scores following SCIT. At baseline, the majority of patients (55%) presented with severe symptoms, but a progressive decline in scores was observed at six and twelve months [15]. These results corroborate international guidelines and studies by Canonica et al. and Nelson, which confirm that allergen immunotherapy leads to long-term symptom control. The VAS scores also showed a parallel trend, highlighting subjective improvement in nasal and ocular symptoms, which directly correlates with patient comfort [16]. Another important parameter was the reduction in rescue medication usage. At baseline, 90% of patients required antihistamines or intranasal corticosteroids, which declined dramatically to 10% after one year. This reduction indicates that SCIT reduces pharmacological dependency, a major advantage considering the long-term cost and potential side effects of symptomatic medications [17].

Quality of life, measured using the RQLQ score, improved significantly across all domains including sleep, daily activities, and emotional well-being. This improvement is clinically relevant, as allergic rhinitis not only causes physical symptoms but also affects mental health and social interactions. These findings are consistent with large-scale European and Asian trials demonstrating the holistic benefits of immunotherapy [18,19].

The safety profile of SCIT was favorable, with only local injection-site reactions (12%) and a few mild systemic reactions (4%), none of which were life-threatening. This supports existing evidence that immunotherapy is generally well-tolerated when administered under medical supervision [20].

The overall findings of this study emphasize that SCIT is an effective, safe, and long-term therapeutic option for allergic rhinitis. It addresses both symptom control and quality of life, with minimal adverse effects. However, limitations of the study include its single-center design, lack of a placebo-controlled group, and the relatively small sample size, which restrict generalizability. Future research should focus on multi-center randomized controlled trials with larger cohorts, exploring sublingual immunotherapy as an alternative, and evaluating immunological biomarkers predictive of treatment success.

Conclusion

This prospective research compared the efficacy of subcutaneous immunotherapy (SCIT) in patients with allergic rhinitis aged 20-40 years for one year. The outcomes proved that there was considerable improvement in the severity of symptoms, as supported by a great decrease in Total Nasal Symptom Score (TNSS) and Visual Analogue Scale (VAS) scores. There was also significantly reduced need for rescue drugs, suggesting better disease control with less pharmacologic dependency. Further, quality of life also significantly improved, an indication of the comprehensive benefits of immunotherapy over simple symptom relief.

The safety profile of SCIT in this trial was excellent, with mild local and systemic reactions only and no severe or life-threatening adverse effects. These results validate the use of SCIT as a disease-modifying therapy for allergic rhinitis with long-term clinical effects that cannot be obtained with conventional pharmacotherapy alone.

Yet the study possessed limitations, such as being single-center and having a small sample size, which limit the ability to generalize the findings. Albeit these limitations, the evidence points rather convincingly that SCIT is an important therapeutic option for selected patients with allergic rhinitis, especially those who have chronic symptoms despite best medical care.

Subsequent studies need to incorporate larger, multicentric trials with longer follow-up to assess sustained efficacy, cost-effectiveness, and comparative outcomes among different immunotherapy modalities like subcutaneous and sublingual routes. Incorporation of biomarker analysis can further improve selection of patients and predict therapeutic response.

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