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Original Research Article

AEROALLERGEN SENSITIZATION PATTERNS IN BRONCHIAL ASTHMA PATIENTS WITH AND WITHOUT ALLERGIC RHINITIS: A SKIN PRICK TEST-BASED STUDY FROM NORTH INDIA

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ABSTRACT

Background: Bronchial asthma (BA) and allergic rhinitis (AR) frequently coexist, sharing common immunological pathways. Identification of allergen sensitization patterns is crucial for targeted management. **Objective:** To compare skin sensitivity to various aeroallergens using skin prick test (SPT) in patients with BA alone versus those with BA and coexisting AR. **Materials and Methods:** This prospective interventional study included 250 patients (18-60 years) with clinically diagnosed BA (GINA criteria), with or without AR (ARIA criteria). SPT was performed using 12 common aeroallergens including house dust mite (Dermatophagoides pteronyssinus), insect allergens (mosquito, cockroach male and female), pollen allergens (Holoptelea integrifolia, Azadirachta indica, Putranjiva roxburghii), and fungal allergens (Aspergillus fumigatus, A. flavus, A. niger). Wheal diameter ≥3 mm was considered positive. **Results:** Of 250 patients, 135 (54%) had BA with AR and 115 (46%) had BA alone. Overall SPT positivity was higher in the BA+AR group (75.6%) compared to BA alone (62.6%). Sensitization to Dermatophagoides pteronyssinus was significantly higher in BA+AR (57.6% vs 38.4%, p=0.003). Similarly, insect allergen sensitization (68.0% vs 49.6%, p=0.004), pollen allergens (55.2% vs 28.8%, p<0.001), and fungal allergens (40.8% vs 23.2%, p=0.006) were significantly more prevalent in patients with coexisting AR. **Conclusion:** Patients with bronchial asthma and concomitant allergic rhinitis demonstrate significantly higher sensitization rates to multiple aeroallergen categories compared to those with asthma alone, supporting the unified airway disease concept. Routine allergen evaluation using SPT is recommended for comprehensive management.

INTRODUCTION

Allergic disorders represent a significant global health burden, with bronchial asthma (BA) and allergic rhinitis (AR) being the most common chronic respiratory conditions worldwide.[1] These conditions exemplify the concept of "united airway disease," wherein inflammatory processes in the upper and lower respiratory tracts are interconnected through shared pathophysiological mechanisms.[2]

Bronchial asthma affects 1-18% of the global population, while allergic rhinitis impacts approximately 30% of adults and up to 40% of children.[3] In India, asthma prevalence ranges from 2-15% with notable regional variations, and allergic rhinitis affects 20-30% of the population, often demonstrating significant urban-rural disparities.[4] Importantly, more than 80% of asthmatic patients have clinically significant rhinitis, and 30-40% of rhinitis patients develop asthma, typically within five years of rhinitis onset.[5]

Both conditions share common immunological mechanisms, including IgE-mediated hypersensitivity, Th2-type inflammatory responses, and eosinophilic infiltration.[6] The presence of comorbid AR in asthmatic patients is associated with

poorer disease control, increased exacerbations, higher healthcare utilization, and diminished quality of life.[7]

Skin prick testing (SPT) remains the cornerstone diagnostic tool for identifying IgE-mediated sensitization to environmental allergens. It offers rapid results, cost-effectiveness, high sensitivity, and excellent negative predictive value when performed according to standardized protocols.[8] Identification of specific allergen sensitization enables targeted environmental control measures, appropriate patient counseling, and consideration of allergen immunotherapy.[9]

While the clinical significance of allergen sensitization in airway diseases is well-established, there exists a knowledge gap regarding comparative sensitization patterns between patients with isolated BA and those with BA+AR, particularly in the Indian context with its diverse climatic zones and allergen profiles.[10] Regional variations in allergen exposure necessitate location-specific data to guide management strategies.[11]

This study aimed to evaluate and compare skin sensitivity to common aeroallergens using SPT in patients with bronchial asthma, with and without associated allergic rhinitis, in the Bareilly region of North India.

MATERIALS AND METHODS

Study Design and Setting

This prospective interventional study was conducted in the Department of Respiratory Medicine at Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India, after approval from the institutional ethics committee. A total of 250 patients aged 18–60 years with clinically diagnosed bronchial asthma, with or without allergic rhinitis, were enrolled based on diagnoses established using Global Initiative for Asthma (GINA) and Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines. All participants underwent detailed clinical evaluation, chest radiography, hematological investigations, and spirometry with bronchodilator reversibility testing as per American Thoracic Society/European Respiratory Society (ATS/ERS) recommendations. Skin prick testing was performed after appropriate medication washout using a standardized panel of 12 aeroallergens, with histamine and saline as positive and negative controls, respectively, and results were interpreted based on wheal size criteria, considering reactions ≥2+ as significant.[12] Patients with conditions or treatments interfering with SPT, acute exacerbations, pregnancy, or relevant comorbidities were excluded. Data were analyzed using SPSS software, with categorical variables expressed as frequencies and percentages, group comparisons performed using the chi-square test, and statistical significance set at $p < 0.05$.

RESULTS

Table 1: Distribution of BA patients with and without AR

Clinical Group	Number of Patients (n)	Percentage (%)
Bronchial asthma alone	115	46.0
Bronchial asthma with allergic rhinitis	135	54.0
Total	250	100

A total of 250 patients with bronchial asthma were enrolled, comprising 135 (54%) with coexisting allergic rhinitis (BA+AR group) and 115 (46%) with asthma alone (BA group). [Table 1]

Table 2: Gender-Wise Distribution

Clinical Group	Male n (%)	Female n (%)	Total
Bronchial asthma alone	68 (59.1%)	47 (40.9%)	115
Bronchial asthma with allergic rhinitis	79 (58.5%)	56 (41.5%)	135
Total	147 (58.8%)	103 (41.2%)	250

Male predominance was observed in both groups, with overall 147 males (58.8%) and 103 females (41.2%). [Table 2]

Table 3: Overall SPT Results

Clinical Group	SPT Positive n (%)	SPT Negative n (%)	Total
Bronchial asthma alone	72 (62.6%)	43 (37.4%)	115
Bronchial asthma with allergic rhinitis	102 (75.6%)	33 (24.4%)	135
Total	174 (69.6%)	76 (30.4%)	250

Of the 250 patients, 174 (69.6%) demonstrated positive SPT reactions to at least one allergen. SPT positivity was higher in the BA+AR group (102/135, 75.6%) compared to the BA alone group (72/115, 62.6%). [Table 3]

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Table 4: Allergen-wise SPT Positivity in BA Alone Group

Allergen	Positive (n)	Percentage (%)
Dermatophagoides pteronyssinus	48	41.7
Holoptelea integrifolia	26	22.6
Azadirachta indica	21	18.3
Putranjiva roxburghii	14	12.2
Cockroach (female)	29	25.2
Cockroach (male)	24	20.9
Mosquito	19	16.5
Aspergillus fumigatus	22	19.1
Aspergillus flavus	18	15.7
Aspergillus niger	15	13.0

Dermatophagoides pteronyssinus was the most common allergen, positive in 48 patients (41.7%), followed by cockroach female (25.2%), cockroach male (20.9%), Holoptelea integrifolia (22.6%), and Aspergillus fumigatus (19.1%). [Table 4]

Table 5: Allergen-wise SPT Positivity in BA with AR Group

Allergen	Positive (n)	Percentage (%)
Dermatophagoides pteronyssinus	76	56.3
Holoptelea integrifolia	39	28.9
Azadirachta indica	34	25.2
Putranjiva roxburghii	25	18.5
Cockroach (female)	42	31.1
Cockroach (male)	37	27.4
Mosquito	31	23.0
Aspergillus fumigatus	36	26.7
Aspergillus flavus	29	21.5
Aspergillus niger	24	17.8

Again, Dermatophagoides pteronyssinus was the most prevalent allergen, positive in 76 patients (56.3%), followed by cockroach female (31.1%), Holoptelea integrifolia (28.9%), cockroach male (27.4%), and Aspergillus fumigatus (26.7%). [Table 5]

Table 6: Comparison of HDM Sensitization

Sensitization Status	Bronchial Asthma (n=125)	Bronchial Asthma with Allergic Rhinitis (n=125)	Total (n=250)	p-value
Positive	48 (38.4%)	72 (57.6%)	120 (48.0%)	0.003
Negative	77 (61.6%)	53 (42.4%)	130 (52.0%)	
Total	125 (100%)	125 (100%)	250 (100%)	

Sensitization to Dermatophagoides pteronyssinus was significantly higher in the BA+AR group (57.6%) compared to the BA alone group (38.4%) (p=0.003). [Table 6]

Table 7: Comparison of Insect Allergen Sensitization

Sensitization Status	Bronchial Asthma (n=125)	Bronchial Asthma with Allergic Rhinitis (n=125)	Total (n=250)	p-value
Positive	62 (49.6%)	85 (68.0%)	147 (58.8%)	0.004
Negative	63 (50.4%)	40 (32.0%)	103 (41.2%)	
Total	125 (100%)	125 (100%)	250 (100%)	

Sensitization to at least one insect allergen (mosquito, cockroach male/female) was significantly higher in the BA+AR group (68.0%) compared to BA alone (49.6%) (p=0.004). [Table 7]

Table 8: Comparison of Pollen Allergen Sensitization

Sensitization Status	Bronchial Asthma (n=125)	Bronchial Asthma with Allergic Rhinitis (n=125)	Total (n=250)	p-value
Positive	36 (28.8%)	69 (55.2%)	105 (42.0%)	<0.001
Negative	89 (71.2%)	56 (44.8%)	145 (58.0%)	
Total	125 (100%)	125 (100%)	250 (100%)	

Sensitization to at least one pollen allergen (Holoptelea, Azadirachta, Putranjiva) was markedly higher in the BA+AR group (55.2%) compared to BA alone (28.8%) (p<0.001). [Table 8]

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Table 9: Comparison of Fungal Allergen Sensitization

Sensitization Status	Bronchial Asthma (n=125)	Bronchial Asthma with Allergic Rhinitis (n=125)	Total (n=250)	p-value
Positive	29 (23.2%)	51 (40.8%)	80 (32.0%)	0.006
Negative	96 (76.8%)	74 (59.2%)	170 (68.0%)	
Total	125 (100%)	125 (100%)	250 (100%)	

Sensitization to at least one Aspergillus species was significantly higher in the BA+AR group (40.8%) compared to BA alone (23.2%) (p=0.006). [Table 9]

DISCUSSION

The present study demonstrates that patients with bronchial asthma and concomitant allergic rhinitis exhibit significantly higher rates of sensitization to multiple aeroallergen categories compared to those with asthma alone. These findings provide strong support for the unified airway disease concept and underscore the importance of comprehensive allergen evaluation in asthmatic patients, particularly those with upper respiratory symptoms.

House Dust Mite Sensitization

Dermatophagoides pteronyssinus emerged as the predominant sensitizing allergen in both groups, with significantly higher prevalence in the BA+AR group (57.6% vs 38.4%, p=0.003). This finding aligns with multiple Indian studies. Katoch et al,[13] reported HDM sensitization rates of 49.85% in patients with allergic airway disease in Maharashtra. Similarly, Kothandarama et al,[14] found D. pteronyssinus positivity in 45.2% of patients with AR and asthma in North India, with highest prevalence in those with comorbid asthma. Dey et al,[15] reported even higher rates (80.34%) in West Bengal, possibly reflecting regional climatic variations favoring mite proliferation. The higher mite sensitization in patients with combined disease likely reflects the role of nasal mucosa as an early sensitization site, with continuous allergen exposure perpetuating inflammation and priming immune responses that subsequently involve the lower airways.[16]

Insect Allergen Sensitization

Significantly higher insect allergen sensitization in the BA+AR group (68.0% vs 49.6%, p=0.004) corroborates findings from Sharma et al,[17] who reported insects as the most common allergen category (37.7%) in BA alone patients, with even higher rates in those with AR. Prasad et al,[18] from Lucknow (geographically close to our study area) also documented substantial insect allergen reactivity, particularly to cockroaches and locusts. Cockroach allergens are well-recognized risk factors for asthma morbidity, particularly in urban and semi-urban settings with poor housing conditions.[19] The higher sensitization in patients with AR suggests that nasal inflammation may facilitate immune recognition of these indoor allergens, predisposing to lower airway involvement.

Pollen Allergen Sensitization

The most striking difference between groups was observed for pollen allergens (55.2% vs 28.8%, p<0.001). Sharma et al,[17] similarly reported pollens as the predominant aeroallergen in AR patients with or without BA (45.16% and 48.75% respectively). The high prevalence of sensitization to Holoptelea integrifolia (Chirol) in our region reflects its widespread presence in North India, where it serves as a major respiratory allergen during its flowering season.[20] The enhanced pollen sensitization in patients with AR can be explained by the direct and continuous exposure of nasal epithelium to airborne pollens, leading to local IgE production and subsequent systemic immune activation.[21]

Fungal Allergen Sensitization

Significantly higher sensitization to Aspergillus species in the BA+AR group (40.8% vs 23.2%, p=0.006) is consistent with findings from Katoch et al,[13] and Dey et al.[15] Fungal sensitization has been associated with more severe asthma, poorer disease control, and increased healthcare utilization.[22] The higher rates in patients with combined disease may reflect enhanced antigen penetration through inflamed nasal mucosa and the chronicity of airway inflammation.

Clinical Implications

Our findings have several important clinical implications:

Routine Allergen Testing: The high prevalence of sensitization (69.6% overall) supports routine SPT in all asthmatic patients, particularly those with nasal symptoms.[23]

Unified Airway Approach: The significantly higher sensitization in patients with AR reinforces the need for integrated management of upper and lower airways, as treating one may benefit the other.[24]

Targeted Environmental Control: Identification of specific allergens enables customized avoidance strategies. For HDM, measures include impermeable mattress covers, washing bedding at ≥60°C, reducing indoor humidity, and using HEPA filters.[25]

Immunotherapy Consideration: Allergen immunotherapy represents the only disease-modifying treatment with evidence for preventing asthma development in AR patients and reducing symptom severity in established disease.[26]

Regional Relevance: Our data provide region-specific information for the Bareilly region, highlighting the importance of local allergen panels rather than extrapolating from other geographical areas.[27]

Strengths and Limitations: This study has several notable strengths. It included an adequate sample size

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(n = 250), which enhances the reliability of the findings. Diagnostic classification was performed with strict adherence to established international guidelines, namely the Global Initiative for Asthma (GINA) and the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines, ensuring diagnostic accuracy and consistency. Skin prick testing (SPT) was conducted using a standardized methodology in accordance with European recommendations, minimizing procedural variability. The study design allowed comparison between clearly defined clinical groups, strengthening internal validity. Additionally, the use of a region-specific allergen panel improved the relevance of the findings to the local population.

However, certain limitations should be acknowledged. As a single-center study, the findings may not be generalizable to other regions with different environmental and allergen profiles. Two potential allergens, Madhuca longifolia and Aspergillus terreus, could not be included due to non-availability, possibly leading to underestimation of sensitization. The absence of serum-specific IgE measurements limited the ability to correlate SPT results with immunological markers. Furthermore, the lack of a healthy control group restricted comparative interpretation. The cross-sectional design precluded assessment of temporal changes in allergen sensitization, and the absence of quantitative symptom scores and quality-of-life measures limited evaluation of clinical severity and patient-reported outcomes.

CONCLUSION

This study demonstrates that patients with bronchial asthma and concomitant allergic rhinitis exhibit significantly higher sensitization rates to house dust mites, insect allergens, pollen allergens, and fungal allergens compared to those with asthma alone. Dermatophagoides pteronyssinus is the predominant sensitizing allergen in both groups, with notably higher prevalence in patients with combined disease. These findings reinforce the unified airway disease concept and emphasize the importance of routine allergen evaluation using skin prick testing in all asthmatic patients, particularly those with nasal symptoms. Early identification of specific allergen sensitization enables targeted environmental control measures, appropriate patient education, and consideration of allergen immunotherapy, potentially improving disease outcomes and quality of life.

Future multicenter studies across diverse Indian geographical regions with standardized allergen panels and inclusion of serum-specific IgE measurements would further enhance our understanding of regional sensitization patterns and their clinical correlations.

REFERENCES

1. Johansson SGO, Bieber T, Dahl R, et al. Revised nomenclature for allergy for global use: Report of the Nomenclature Review Committee of the World Allergy Organization. J Allergy Clin Immunol. 2004;113(5):832-6.
2. Khan DA, Togias A. Allergic rhinitis and asthma: epidemiology and common pathophysiology. Allergy Asthma Proc. 2014;35(5):357-61.
3. Bousquet J, Schünemann HJ, Togias A, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update. Allergy. 2008;63(Suppl 86):8–160.
4. Gupta RS, et al. Allergic rhinitis in India: Current perspectives on prevalence and management. Clin Exp Allergy. 2023;53(7):765-776.
5. Greiner AN, Hellings PW, Rotiroti G, Scadding GK. Allergic rhinitis. Lancet. 2011;378(9809):2112–2122.
6. Abbas AK, Lichtman AH, Pillai S. Cellular and molecular immunology. 9th ed. Philadelphia: Elsevier; 2018.
7. Bousquet J, Van Cauwenberge P, Khaltaev N; ARIA Workshop Group. Allergic rhinitis and its impact on asthma. J Allergy Clin Immunol. 2001;108(5 Suppl):S147–S334.
8. Heinzerling L, Mari A, Bergmann KC, et al. The skin prick test – European standards. Allergy. 2013;68(6):702–712.
9. Canonica GW, Ansotegui IJ, Pawankar R, et al. A WAO-ARIA-GA²LEN consensus document on molecular-based allergy diagnostics. World Allergy Organ J. 2013;6(1):17.
10. Gaur SN, Gupta K, Rajpal S, Singh AB, Rohatgi A. Prevalence of sensitization to common aeroallergens in patients of bronchial asthma and allergic rhinitis in India. Indian J Allergy Asthma Immunol. 2006;20(2):67-73.
11. Agarwal R, Dhooria S, Sehgal IS, et al. Allergic airway diseases in India: current status and future perspectives. Indian J Chest Dis Allied Sci. 2016;58(2):73–83.
12. Dreborg S. Skin tests used in type I allergy testing. Position paper of the European Academy of Allergology and Clinical Immunology. Allergy. 1989;44(Suppl 10):1–59.
13. Katoch S, Chawla K, Shukla M, et al. Pattern of aeroallergen sensitization in patients with allergic airway disease in South-Western Maharashtra, India: a cross-sectional study. Indian J Allergy Asthma Immunol. 2020;34(4):253–260.
14. Kothandarama S, Sharma R, Verma R, et al. Prevalence of aeroallergen sensitization in allergic rhinitis and its association with bronchial asthma: a prospective skin prick test study from North India. Indian J Otolaryngol Head Neck Surg. 2023;75(Suppl 2):1734–1743.
15. Dey S, Chatterjee S, Bhowmick S, et al. Sensitization profile to common aeroallergens in an atopic population of West Bengal, India: a retrospective cross-sectional study. Indian J Allergy Asthma Immunol. 2018;32(2):106–112.
16. Campo P, Oliviero B, Bonini M, et al. Local allergic rhinitis and bronchial asthma: a comparative study with allergic rhinitis and nonallergic rhinitis patients. J Allergy Clin Immunol. 2019;143(4):1290–1296.
17. Sharma R, Sharma M, Meena D, et al. Evaluation of skin sensitivity to allergens in patients with bronchial asthma and allergic rhinitis: a clinical observational study. Indian J Allergy Asthma Immunol. 2018;32(4):241–247.
18. Prasad R, Singh A, Kumar S, et al. Sensitization to aeroallergens in nasobronchial allergy patients: a prospective observational study at King George's Medical University, Lucknow, India. Indian J Allergy Asthma Immunol. 2009;23(3):167–173.
19. Oncham S, Praditpornsilpa K, Ruangvutilert P, et al. Sensitization to aeroallergens in adult patients with allergic symptoms and chronic urticaria: a retrospective cross-sectional study in Thailand. Asian Pac J Allergy Immunol. 2018;36(1):42–48.
20. Mishra S, Verma S, Kumar S, et al. Common allergens in patients with united airway disease: a hospital-based observational study in Allahabad, India. Indian J Allergy Asthma Immunol. 2016;30(4):232–238.
21. Durham SR, Ying S, Varney VA, et al. Cytokine messenger RNA expression for IL-3, IL-4, IL-5, and GM-CSF in the nasal mucosa after allergen challenge. J Clin Invest. 1992;90(3):874–882.

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22. Farrokhi S, Movahedi M, Azizi M, et al. Prevalence of aeroallergen sensitivity in asthma and allergic rhinitis patients in Bushehr, Iran: a cross-sectional study. Iranian J Allergy Asthma Immunol. 2015;14(4):395–402.
23. Burrows B, Martinez FD, Halonen M, Barbee RA, Cline MG. Association of asthma with serum IgE levels and skin-test reactivity. N Engl J Med. 1989;320(5):271–277.
24. Bousquet J, Khaltaev N, Cruz AA, et al. Allergic rhinitis and its impact on asthma (ARIA) 2008 update. Allergy. 2008;63(Suppl 86):8–160.
25. Platts-Mills TAE, de Weck AL. Dust mite allergens and asthma. J Allergy Clin Immunol. 1989;83(2):416–427.
26. Gowda K, Ramesh K, Shastry CS, et al. Sensitization to aeroallergens in bronchial asthma patients: a study at the Allergy Center, Kempegowda Institute of Medical Sciences, Bangalore. Indian J Allergy Asthma Immunol. 2013;27(1):19–23.
27. Larenas-Linnemann D, Rodríguez-Pérez N, Arias-Cruz A, et al. Changes in aeroallergen sensitization patterns over 14 years and their association with climate in Mexico: a nationwide retrospective study. World Allergy Organ J. 2024;17(2):100860.

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