

Prevalence and Clinical Characteristics of Migraine in Patients with Allergic Rhinitis: A Cross-Sectional Study

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Abstract

Background: Allergic rhinitis (AR) is one of the most prevalent chronic inflammatory and immune mediated disorders affecting the upper airway and has a considerable impact on patients' quality of life. Migraine is a disabling primary headache disorder that shares several inflammatory and neurovascular mechanisms with allergic diseases. Increasing evidence suggests that patients with allergic rhinitis may have a higher frequency of migraine than the general population, although the reported prevalence varies across different populations. Understanding this association may improve clinical recognition and comprehensive patient management.

Objectives: To determine the prevalence of migraine among patients diagnosed with allergic rhinitis and to describe the demographic and clinical characteristics of affected individuals.

Materials and Methods: An OPD-based cross-sectional study was conducted among 200 consecutive patients diagnosed with allergic rhinitis in the Department of Otorhinolaryngology of Dr Panjabrao memorial medical college, Amravati. Allergic rhinitis was diagnosed according to the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines, while migraine was diagnosed using the International Classification of Headache Disorders, Third Edition (ICHD-3) criteria. Demographic variables, clinical characteristics, age distribution, sex, and disease severity were recorded. The prevalence of migraine was calculated as the proportion of allergic rhinitis patients fulfilling ICHD-3 diagnostic criteria.

Results: Among the 200 patients with allergic rhinitis, 46 fulfilled the diagnostic criteria for migraine, yielding an overall prevalence of **23.0%**. Migraine was observed predominantly in patients aged between 20 and 40 years. Female patients constituted the majority of migraine cases (36 of 46), while males accounted for 10 cases. Migraine occurred more frequently among patients with moderate-to-severe allergic rhinitis than among those with milder disease.

Conclusion: Nearly one-quarter of patients with allergic rhinitis experienced migraine in the present study. Young adults and female patients were more commonly affected, with migraine occurring predominantly in individuals with moderate-to-severe allergic rhinitis. These findings support routine headache assessment in patients presenting with allergic rhinitis to facilitate early diagnosis and multidisciplinary management.

Keywords: Allergic rhinitis; Migraine; ARIA; ICHD-3; Headache; Cross-sectional study; Prevalence; Otorhinolaryngology

Introduction

Allergic rhinitis (AR) is a chronic immunoglobulin E (IgE)-mediated inflammatory disorder of the nasal mucosa characterized by nasal obstruction, rhinorrhea, and sneezing, itching, and postnasal discharge following exposure to environmental allergens. It affects approximately 10–30% of the global population and represents one of the most common chronic disorders encountered in otorhinolaryngology practice. Although traditionally considered a localized nasal disease, allergic rhinitis is now recognized as a systemic inflammatory condition with widespread clinical implications. Persistent nasal symptoms adversely affect sleep quality, cognitive performance, work productivity, and overall quality of life, contributing substantially to healthcare utilization and socioeconomic burden.^{1–4}

Migraine is a common neurological disorder characterized by recurrent attacks of moderate-to-severe headache, often accompanied by aura (nausea, vomiting, photophobia, phonophobia,) and sensory hypersensitivity. According to the Global Burden of Disease Study, migraine remains among the leading causes of disability worldwide, particularly affecting individuals during their most productive years.^{5–8} Its prevalence is considerably higher in women than in men and reaches its peak during early and middle adulthood.^{6, 8, 25}

Emerging evidence indicates that allergic rhinitis and migraine frequently coexist. This relationship has attracted increasing scientific interest because both disorders involve inflammatory mediators, neurogenic inflammation, autonomic dysfunction, and activation of the trigemino vascular system. Histamine, substance P, calcitonin gene-related peptide (CGRP), cytokines, and other inflammatory mediators released during allergic responses may contribute to headache generation by sensitizing trigeminal nociceptive pathways. Nasal mucosal inflammation can further enhance trigeminal activation, potentially lowering the threshold for migraine attacks.^{13, 14, 19, 23, 24}

Several epidemiological studies have demonstrated a higher prevalence of migraine among patients with allergic diseases compared with the general population. However, the reported prevalence varies considerably because of differences in study populations, diagnostic criteria, geographic regions, environmental allergen exposure, and healthcare access. While some investigators have reported migraine prevalence approaching one-third of patients with allergic rhinitis, others have found more modest associations. Such variability underscores the need for region-specific epidemiological data using standardized diagnostic criteria.^{5, 6, 25}

The relationship between allergic rhinitis severity and migraine has also become an area of growing interest. Patients with persistent or moderate-to-severe allergic rhinitis appear to experience headaches more frequently than those with intermittent or mild disease. Chronic inflammation, persistent nasal congestion, sleep disturbance, and repeated activation of inflammatory pathways may contribute to this association.^{1, 2, 17–19} Recognition of migraine in patients with allergic rhinitis is clinically important because untreated headache significantly impairs quality of life and may reduce treatment satisfaction despite adequate control of nasal symptoms.^{6, 20, 25}

From an otorhinolaryngologist's perspective, patients presenting with recurrent facial pain or headache are frequently evaluated for sinonasal disease. Migraine is often misdiagnosed as sinus headache, resulting in delayed neurological evaluation and inappropriate treatment. Conversely, patients with established migraine may have concomitant allergic rhinitis that contributes to headache frequency or severity. Therefore, careful assessment of both conditions is essential to optimize patient care.^{5, 20, 23}

The present study was undertaken to estimate the prevalence of migraine among patients with allergic rhinitis attending a tertiary care otorhinolaryngology department using standardized ARIA and ICHD-3

diagnostic criteria.^{1,5} The findings are expected to improve awareness regarding the coexistence of these disorders and support early multidisciplinary management strategies aimed at reducing disease burden and improving patient outcomes.

Objectives

Primary Objective

To determine the prevalence of migraine among patients with allergic rhinitis using the International Classification of Headache Disorders, Third Edition (ICHD-3) criteria.

Secondary Objectives

- To evaluate the age and sex distribution of migraine among patients with allergic rhinitis.
- To assess the association between allergic rhinitis severity and the occurrence of migraine.
- To identify the demographic and clinical characteristics of allergic rhinitis patients with migraine.
- To emphasize the importance of routine migraine screening in patients presenting with allergic rhinitis in otorhinolaryngology practice.

Materials and Methods

Study Design

A hospital-based cross-sectional observational study was conducted to determine the prevalence of migraine among patients diagnosed with allergic rhinitis attending the outpatient Department of Otorhinolaryngology at a Panjabrao memorial medical college and hospital.

Study Duration

The study was conducted over a period of 12 months from October 2022 to September 2023.

Study Population

Patients attending the ENT outpatient department with symptoms suggestive of allergic rhinitis were screened. Individuals fulfilling the diagnostic criteria according to the **Allergic Rhinitis and its Impact on Asthma (ARIA)** guidelines were enrolled consecutively after obtaining written informed consent.

Sample Size

A total of **200 consecutive patients** with allergic rhinitis were included in the study.

Inclusion Criteria

- Patients aged ≥ 18 years.
- Clinically diagnosed allergic rhinitis according to ARIA guidelines.
- Patients willing to participate and provide informed consent.

Exclusion Criteria

- Acute rhinosinusitis or chronic rhinosinusitis with nasal polyposis.
- Previous sinonasal surgery.
- Secondary causes of headache.
- Intracranial pathology.
- Pregnancy.
- Patients with incomplete clinical records.

Diagnostic Criteria

Allergic Rhinitis

Diagnosis was established according to the **ARIA guidelines**, based on characteristic symptoms including:

Sneezing, Nasal itching, Rhinorrhoea, Nasal obstruction. Symptoms occurring for ≥ 1 hour on most days together with compatible clinical examination findings were considered diagnostic. Severity was classified according to ARIA into: Mild and Moderate-to-severe. Disease duration was categorized as: Intermittent or Persistent

Migraine

Migraine was diagnosed according to the **International Classification of Headache Disorders, Third Edition (ICHD-3)**.

Patients fulfilling ICHD-3 diagnostic criteria were classified as migraine sufferers irrespective of aura status.

Study Variables

The following variables were recorded using a structured proforma:

- Age
- Gender
- Duration of allergic rhinitis
- Severity of allergic rhinitis
- Presence of migraine
- Migraine characteristics
- Associated allergic symptoms
- Relevant medical history

Data Collection

Following detailed history and ENT examination, eligible patients underwent migraine assessment using the ICHD-3 diagnostic questionnaire. Demographic and clinical information was entered into a standardized case record form.

Outcome Measure

The primary outcome was:

Prevalence of migraine among patients with allergic rhinitis.

Secondary outcomes included:

- Age distribution
- Gender distribution
- Association with allergic rhinitis severity

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using **SPSS version ____ (IBM Corp., Armonk, NY, USA)**.

Continuous variables were expressed as mean $\pm$ standard deviation where applicable.

Categorical variables were expressed as frequency and percentage.

Migraine prevalence was calculated as:

$$\text{Prevalence} = \frac{\text{Number of migraine patients}}{\text{Total AR patients}} \times 100$$
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Associations between categorical variables were assessed using the Chi-square test. A p-value < 0.05 was considered statistically significant where applicable.

Results

Among the 200 patients diagnosed with allergic rhinitis, 46 fulfilled the ICHD-3 diagnostic criteria for migraine, yielding an overall prevalence of **23.0%**. Female patients constituted **78.3%** of migraine cases, while males accounted for **21.7%**, demonstrating a marked female predominance.

The majority of allergic rhinitis patients were aged **20–40 years (52.5%)**. Within the migraine cohort, the highest number of cases also occurred in the **20–40-year age group (22 patients; 47.8%)**. However, the age-specific prevalence of migraine increased with advancing age, being **6.7%** in patients younger than 20 years, **21.0%** in those aged 20–40 years, **33.3%** in those aged 41–60 years, and **34.5%** in patients older than 60 years.

Migraine prevalence also increased progressively with allergic rhinitis severity. Patients with mild allergic rhinitis had a migraine prevalence of **9.2%**, compared with **23.8%** in moderate disease and **38.2%** in severe disease. Nearly half of all migraine cases (45.7%) occurred among patients with severe allergic rhinitis, suggesting a positive association between increasing allergic rhinitis severity and migraine occurrence.

Table 1. Demographic Characteristics of Allergic Rhinitis Patients (n = 200)

Variable	Number	Percentage (%)
Sex		
Male	76	38.0
Female	124	62.0
Age Group (years)		
<20	30	15.0
20–40	105	52.5
41–60	36	18.0
>60	29	14.5

Table 2. Prevalence of Migraine among Allergic Rhinitis Patients

Migraine Status	Number	Percentage (%)
Present	46	23.0
Absent	154	77.0
Total	200	100

Table 3. Sex Distribution of Migraine Patients (n = 46)

Gender	Number	Percentage (%)
Male	10	21.7
Female	36	78.3
Total	46	100

Table 4. Severity of Allergic Rhinitis among Migraine Patients

AR Severity	Migraine Patients	Percentage (%)
Mild	6	13.0
Moderate	19	41.3
Severe	21	45.7
Total	46	100

Table 5. Prevalence of Migraine According to Allergic Rhinitis Severity

AR Severity	Total AR Patients	Migraine Patients	Prevalence (%)
Mild	65	6	9.2
Moderate	80	19	23.8
Severe	55	21	38.2
Total	200	46	23.0

Table 6. Summary of Major Findings

Parameter	Result
Study Design	Cross-sectional
Sample Size	200
Migraine Prevalence	23.0%
Most Common Age Group (AR)	20–40 years
Female Migraine Patients	78.3%
Highest Migraine Prevalence	Severe AR (38.2%)
Diagnostic Criteria	ARIA and ICHD-3

Discussion

The present study investigated the burden of migraine among patients with allergic rhinitis attending a tertiary care otorhinolaryngology clinic. Using standardized ARIA criteria for allergic rhinitis and ICHD-3 criteria for migraine, migraine was identified in **46 of 200 patients**, corresponding to a prevalence of **23.0%**. This observation suggests that migraine is a frequent comorbidity in patients with allergic rhinitis and highlights the importance of considering headache disorders during routine ENT evaluation.^{1, 2, 5}

The prevalence observed in this study is comparable with findings reported from several hospital-based and community-based investigations that have demonstrated a higher occurrence of migraine among individuals with allergic disorders than in the general population. Although the exact prevalence differs across studies, these differences are expected because of variations in patient demographics, environmental allergen exposure, healthcare access, diagnostic criteria, and study methodology.^{2, 6, 9, 19} By employing internationally accepted diagnostic guidelines for both allergic rhinitis and migraine, the present study provides a reliable estimate of migraine prevalence within an ENT outpatient population.^{1, 5}

A growing body of evidence supports the concept that allergic rhinitis and migraine may be biologically interconnected rather than occurring together by chance. Allergic inflammation involves activation of mast cells, eosinophils, and T-helper-2 pathways, resulting in the release of histamine, leukotrienes, prostaglandins, cytokines, and other inflammatory mediators. These mediators can influence sensory nerve pathways and may contribute to neuronal hyperexcitability and sensitization. In parallel, migraine is increasingly recognized as a disorder involving abnormal sensory processing and activation of the trigeminovascular system. Persistent inflammatory stimulation associated with allergic disease may therefore contribute to lowering the threshold for headache in susceptible individuals.^{2, 8, 12, 17, 18}

Histamine may represent one of the potential biological links between allergic inflammation and headache. During allergic reactions, mast-cell activation results in histamine release, which can produce vasodilatation, increased vascular permeability, and stimulation of sensory nerve endings. Histaminergic mechanisms have also been investigated in migraine pathophysiology. In addition, calcitonin gene-related peptide (CGRP) is a major neuropeptide involved in trigeminovascular activation and migraine pathophysiology. The therapeutic efficacy of CGRP-targeted treatments further supports its central role in migraine biology. These overlapping inflammatory and neurovascular mechanisms provide a plausible biological basis for the coexistence of allergic rhinitis and migraine.^{12, 13, 17, 18}

A notable finding of the present study was the predominance of female patients among migraine cases. Of the 46 patients diagnosed with migraine, **36 (78.3%) were women**, whereas **10 (21.7%) were men**. This pattern is consistent with the established epidemiology of migraine, which demonstrates a substantially greater burden among women, particularly during the reproductive years. Hormonal influences, including fluctuations in estrogen levels, together with sex-related differences in pain processing, are considered important contributors to this disparity.^{6–9} The findings therefore reinforce the importance of maintaining a high index of suspicion for migraine among female patients presenting to ENT clinics with allergic rhinitis and recurrent headache.

More than half of the allergic rhinitis cohort belonged to the **20–40-year age group**, and this age category also contained the largest number of migraine cases. This period represents an important phase of professional, academic, and family responsibilities, during which recurrent migraine can result in substantial disability. Migraine has been recognized as a major contributor to disability globally, particularly among young women. Recurrent headache occurring in combination with chronic nasal symptoms may further impair concentration, productivity, sleep, and overall quality of life. Early recognition of migraine in this age group may therefore provide important functional and socioeconomic benefits.^{6, 7, 9, 19}

When migraine prevalence was analysed according to allergic rhinitis severity, a clear upward trend emerged. Only **9.2%** of patients with mild allergic rhinitis experienced migraine compared with **23.8%** of those with moderate disease and **38.2%** of patients with severe disease. Furthermore, almost half of all migraine cases occurred in individuals with severe allergic rhinitis. This progressive increase suggests that the intensity or persistence of allergic rhinitis may be associated with a greater burden of migraine. Severe allergic rhinitis is commonly characterized by more persistent nasal symptoms, obstruction, sleep disturbance, and inflammatory activity. Such factors may contribute indirectly to headache susceptibility through impaired sleep, sensory irritation, and activation of trigeminal pathways.^{1–3, 16–18}

These observations have practical implications for otorhinolaryngologists. Patients with allergic rhinitis frequently report headache, facial discomfort, or nasal pressure, symptoms that may sometimes be attributed exclusively to sinonasal disease. Conversely, migraine may produce craniofacial symptoms that

overlap with complaints commonly encountered in ENT practice. Failure to distinguish primary headache disorders from symptoms attributable to rhinitis or other sinonasal conditions may lead to inappropriate treatment or delayed diagnosis. Incorporating a structured headache history and applying ICHD-3 diagnostic criteria when migraine is suspected may therefore improve diagnostic accuracy and facilitate appropriate referral.^{3,5,15} Similarly, clinicians managing migraine should consider coexisting allergic rhinitis when prominent nasal or allergic symptoms are present, because appropriate management of both conditions may improve the patient's overall symptom burden.¹⁻⁵

The present investigation has several methodological strengths. Standardized diagnostic criteria were applied for both allergic rhinitis and migraine, reducing diagnostic heterogeneity. Consecutive recruitment minimized the potential for selection bias, while inclusion of patients across different allergic rhinitis severity categories enabled assessment of the relationship between disease severity and migraine prevalence. The use of internationally recognized diagnostic frameworks, particularly ARIA recommendations and ICHD-3 criteria, further strengthens the methodological consistency of the study.^{1,5} Certain limitations should also be acknowledged. The study was conducted at a single tertiary care centre, which may limit extrapolation of the findings to the general population. The cross-sectional design identifies associations but cannot establish temporal or causal relationships between allergic rhinitis and migraine. Information regarding migraine subtype, attack frequency, disability scores, allergen sensitization, serum IgE concentrations, eosinophil counts, sleep quality, psychological stress, and treatment response was not collected. In addition, potential confounding factors such as medication use and other headache-associated comorbidities were not systematically evaluated. Future multicentre prospective studies incorporating clinical phenotyping, allergen sensitization profiles, inflammatory biomarkers, headache disability measures, and longitudinal follow-up would help clarify the mechanisms underlying this association and determine whether effective control of allergic rhinitis influences migraine frequency or severity.^{16,17,19}

In summary, the present study demonstrates that migraine is a frequent comorbidity among patients with allergic rhinitis, with an overall prevalence of **23.0%**. Female sex and increasing allergic rhinitis severity were associated with a greater burden of migraine. These findings support greater awareness and consideration of migraine, particularly among patients with moderate-to-severe allergic rhinitis and those reporting recurrent or unexplained headache. An integrated approach involving otorhinolaryngologists, allergists, and neurologists may facilitate accurate diagnosis and comprehensive management of both conditions. Recognition of coexisting migraine and allergic rhinitis may ultimately reduce symptom burden, improve quality of life, and avoid unnecessary investigations or inappropriate treatment.^{1-3,5,19}

Conclusion

The present cross-sectional study demonstrated that migraine is a common comorbidity among patients with allergic rhinitis, with an overall prevalence of **23.0%** in the study population. Nearly one in four patients attending the otorhinolaryngology outpatient department for allergic rhinitis fulfilled the International Classification of Headache Disorders, Third Edition (ICHD-3) diagnostic criteria for migraine. This finding reinforces the growing evidence that allergic rhinitis and migraine frequently coexist and may share common inflammatory, immunological, and neurovascular mechanisms.

The study further revealed a distinct female predominance among migraine patients, with women accounting for more than three-fourths of all migraine cases. Although the greatest number of migraine cases was observed in the 20–40-year age group because this represented the largest segment of the study

population, migraine was identified across all age categories. Importantly, the prevalence of migraine increased progressively with the severity of allergic rhinitis, rising from 9.2% in patients with mild disease to 38.2% among those with severe allergic rhinitis. This gradient suggests that greater inflammatory burden may be associated with an increased likelihood of migraine, although causal relationships cannot be established from a cross-sectional design.

The findings emphasize that recurrent headache in patients with allergic rhinitis should not automatically be attributed to sinonasal disease. A substantial proportion of these patients may have coexisting migraine requiring specific evaluation and management. Routine assessment of headache characteristics using standardized diagnostic criteria can facilitate earlier recognition of migraine and reduce the risk of misdiagnosis, unnecessary investigations, and inappropriate treatment. Incorporating migraine screening into routine ENT practice may improve diagnostic accuracy and enhance patient-centred care.

Overall, this study highlights the need for greater collaboration between otorhinolaryngologists, allergists, neurologists, and primary care physicians in the evaluation of patients presenting with allergic rhinitis and headache. Early identification and comprehensive management of both conditions have the potential to improve symptom control, reduce disease burden, enhance quality of life, and optimize healthcare outcomes. Future multicentre prospective studies with larger sample sizes, longer follow-up, and incorporation of immunological biomarkers are warranted to further clarify the pathophysiological relationship between allergic rhinitis and migraine and to determine whether optimal control of allergic inflammation can reduce migraine frequency and severity.

Clinical Implications

- Approximately one-quarter of patients with allergic rhinitis in the present study also had migraine, indicating that headache assessment should become a routine component of ENT outpatient evaluation.
- Female patients and individuals with moderate-to-severe allergic rhinitis appear to represent higher-risk groups and may benefit from targeted migraine screening.
- Use of standardized diagnostic criteria, including ARIA for allergic rhinitis and ICHD-3 for migraine, improves diagnostic consistency and facilitates early recognition of coexisting disease.
- Early diagnosis of migraine may reduce unnecessary antibiotic prescriptions, repeated imaging, and inappropriate treatment for presumed sinonasal headache.
- Multidisciplinary collaboration between otorhinolaryngologists, neurologists, allergists, and primary care physicians may improve overall patient outcomes and quality of life.
- Optimizing allergic rhinitis management may contribute to better headache control in selected patients, although this relationship requires confirmation through prospective interventional studies.

Strengths of the Study

- The study employed internationally accepted **ARIA** and **ICHD-3** diagnostic criteria, ensuring standardized and reliable diagnosis of allergic rhinitis and migraine.
- A clearly defined cross-sectional design enabled estimation of migraine prevalence within a representative tertiary-care ENT outpatient population.
- Consecutive enrolment of patients reduced selection bias and reflected routine clinical practice.
- Assessment of allergic rhinitis severity allowed evaluation of its relationship with migraine occurrence.

- Collection of demographic characteristics facilitated analysis of age- and sex-related trends.
- The study addresses an important but relatively underexplored topic in otorhinolaryngology, providing clinically relevant regional data that may assist future comparative studies.

Limitations of the Study

- The study was conducted at a single tertiary care centre, which may limit the generalizability of the findings to other healthcare settings and community populations.
- The cross-sectional study design identifies associations but cannot establish temporal or causal relationships between allergic rhinitis and migraine.
- The sample size, although adequate for prevalence estimation, may not have been sufficient to evaluate less common demographic or clinical subgroups in detail.
- Migraine-related variables such as attack frequency, duration, disability scores, aura status, medication use, and treatment response were not evaluated.
- Potential confounding factors such as sleep disorders, psychological stress, hormonal influences, obesity, and other comorbidities were not analysed.
- As the study relied on hospital-based participants, referral bias may have resulted in a higher proportion of patients with more severe allergic rhinitis compared with the general population.

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