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Research Article

Study of Incidence of Sensorineural Hearing Loss in Allergic Rhinitis

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ABSTRACT
Background: Allergic rhinitis (AR) is a common condition characterized by inflammation of the nasal mucosa caused by exposure to airborne allergens. Although AR is typically associated with nasal symptoms, increasing evidence suggests that it may also lead to auditory dysfunction. Sensorineural hearing loss (SNHL) is a less-recognized complication of allergic rhinitis, and this study aims to explore the incidence of SNHL in patients with allergic rhinitis in India. Sensorineural hearing loss (SNHL) refers to hearing impairment caused by damage to the inner ear (cochlea) or the auditory nerve. Unlike conductive hearing loss, which is due to problems in the outer or middle ear, SNHL results from dysfunction in the auditory pathway and often presents as permanent hearing loss. One potential, yet often overlooked, contributing factor to SNHL is allergic rhinitis (AR), a condition characterized by inflammation of the nasal mucosa due to allergic reactions to airborne allergens (such as pollen, dust mites, mold, and animal dander). Allergic rhinitis primarily affects the nasal and upper respiratory passages, but the effects of chronic inflammation and immune response may extend to the middle and inner ear. Clinical observations suggest that there may be an association between allergic rhinitis and hearing loss, though the precise pathophysiology and the extent of the problem remain areas of active research.
Aim: This study aims to examine the incidence of sensorineural hearing loss in individuals with allergic rhinitis and explore the mechanisms that could potentially link the two conditions.
Methods: This prospective, observational study included 200 participants (100 with allergic rhinitis and 100 age- and sex-matched healthy controls). Audiometric testing (pure-tone audiometry, speech audiometry) and clinical evaluations were performed to assess hearing function and AR severity.
Results: The study found that 28% of patients with allergic rhinitis exhibited varying degrees of sensorineural hearing loss, compared to 6% in the control group. A significant correlation was observed between the severity of allergic rhinitis symptoms and the degree of hearing loss ($p < 0.05$). Histamine release and chronic inflammation were identified as potential contributors to cochlear damage.
Conclusion: Allergic rhinitis is associated with a higher incidence of sensorineural hearing loss. Early identification and management of hearing impairment in allergic rhinitis patients may improve long-term auditory outcomes.

INTRODUCTION

Allergic rhinitis (AR) is a common condition characterized by inflammation of the nasal mucosa caused by exposure to airborne allergens. Although AR is typically associated with nasal symptoms, increasing evidence suggests that it may also lead to auditory dysfunction.[1-2] Sensorineural hearing loss (SNHL) is a less-recognized complication of allergic rhinitis, and this study aims to explore the incidence of SNHL in patients with allergic rhinitis in India. Sensorineural hearing loss (SNHL) refers to hearing impairment caused by damage to the inner ear (cochlea) or the auditory nerve. Unlike conductive hearing loss, which is due to problems in the outer or middle ear, SNHL results from dysfunction in the auditory pathway and often presents as permanent hearing loss. One potential, yet often overlooked, contributing factor to SNHL is allergic rhinitis (AR), a condition characterized by inflammation of the nasal mucosa due to allergic reactions to airborne allergens (such as pollen, dust mites, mold, and animal dander).[3-5] Allergic rhinitis primarily affects the nasal and upper respiratory passages, but the effects of chronic inflammation and immune response may extend to the middle and inner ear. Clinical observations suggest that there may be an

association between allergic rhinitis and hearing loss, though the precise pathophysiology and the extent of the problem remain areas of active research.Allergic rhinitis (AR), a condition affecting millions worldwide, is characterized by inflammation of the nasal mucosa due to an allergic reaction to environmental allergens such as pollen, dust mites, and animal dander. Common symptoms include nasal congestion, sneezing, itching, and a clear nasal discharge. However, there is a growing body of evidence suggesting that allergic rhinitis may have effects beyond the nasal cavity, potentially influencing auditory function.[6-9]

While AR is predominantly known for its nasal symptoms, an increasing number of studies have reported associations between AR and hearing dysfunction. The condition is linked with middle ear effusion and eustachian tube dysfunction, both of which can affect conductive hearing. However, sensorineural hearing loss (SNHL), which involves damage to the inner ear or auditory nerve, remains a lesser-known complication.[10]

Aim: This study aims to investigate the incidence of sensorineural hearing loss in patients with allergic rhinitis and explore the possible mechanisms behind this association, particularly in the Indian population.

Objectives

1. To determine the prevalence of sensorineural hearing loss in patients diagnosed with allergic rhinitis.
2. To evaluate the correlation between the severity of allergic rhinitis and the degree of hearing loss.
3. To investigate potential mechanisms linking allergic rhinitis to sensorineural hearing loss.

While most studies on allergic rhinitis have focused on its impact on the upper respiratory system (nasal congestion, sneezing, and rhinitis), emerging research has highlighted potential connections with middle ear and auditory function. Some theories suggest that: Eustachian tube dysfunction caused by chronic inflammation of the nasopharynx could affect ear pressure and lead to hearing problems. Inflammatory cytokines, histamine release, and other mediators involved in allergic reactions may adversely affect the cochlea or the auditory nerve. Allergic rhinitis has been linked to an increased risk of middle ear effusion, which may disrupt normal hearing, potentially leading to both conductive and sensorineural hearing loss. However, the understanding of how chronic allergic inflammation may specifically cause sensorineural rather than just conductive hearing loss is still not well established in scientific literature. This study seeks to fill this gap by exploring the incidence and potential mechanisms.

Allergic Rhinitis and Auditory Dysfunction

Allergic rhinitis is associated with several otologic complications, including eustachian tube dysfunction, otitis media, and in some cases, sensorineural hearing loss. Studies have highlighted the impact of chronic allergic inflammation on the auditory system, suggesting that inflammatory mediators such as histamine, prostaglandins, and cytokines may play a role in cochlear damage. Chronic inflammation may result in vasodilation and impaired blood flow to the cochlea, leading to ischemic injury of the auditory structures. A few studies have shown that eustachian tube dysfunction and middle ear effusion associated with allergic rhinitis could increase the risk of conductive hearing loss, but the direct relationship between allergic rhinitis and SNHL is less well documented. Previous studies in populations with chronic allergic inflammation have reported a higher prevalence of hearing loss, although the degree of SNHL and its underlying mechanisms remain areas for further exploration.

METHODS

Study Design: This prospective, observational study included 200 participants (100 with allergic rhinitis and 100 age- and sex-matched healthy controls). Audiometric testing (pure-tone audiometry, speech audiometry) and clinical evaluations were performed to assess hearing function and AR severity. This was a prospective, observational study conducted at the ENT Department of RIMT Medical College & Hospital, Mandi Gobingarh, Punjab over a period of 12 months, from January 2023 to December 2023.

Study Population

- **Inclusion Criteria:**

1. Adults aged 18–65 years.
2. Clinical diagnosis of allergic rhinitis (confirmed by allergy tests, clinical presentation, and positive skin prick test or serum-specific IgE).

3. No history of congenital or acquired hearing loss, ototoxic drug use, or head trauma.

- **Exclusion Criteria:**

1. History of vestibular disorders or significant neurological conditions.
2. Use of medications known to cause ototoxicity.
3. Any chronic systemic illness such as uncontrolled diabetes, hypertension, etc.

Study Groups

1. **Group 1 (Study Group):** 100 patients diagnosed with allergic rhinitis.
2. **Group 2 (Control Group)**: 100 healthy individuals with no history of allergic rhinitis or hearing impairment.

Evaluation and Diagnostic Methods

1. **Audiometric Testing:**

- **Pure-tone audiometry:** Assesses the hearing threshold at various frequencies (250 Hz to 8,000 Hz). The degree of hearing loss (mild, moderate, severe, profound) was classified based on the average threshold across frequencies.
- **Speech audiometry**: Used to assess speech recognition ability.
- **Tympanometry:** To rule out middle ear dysfunction that may contribute to conductive hearing loss.

2. **Clinical Assessment**:

- **Severity of Allergic Rhinitis:** Symptoms were scored based on the frequency and intensity of nasal congestion, sneezing, itching, and rhinorrhea. A visual analog scale (VAS) was used for subjective symptom assessment.
- **Allergy Tests:** Skin prick tests or serum-specific IgE assays were performed to identify common allergens (pollen, dust mites, etc.).

Statistical Analysis

- **Descriptive statistics** were used to summarize participant demographics and clinical features.
- **Chi-square test** was used to compare the incidence of hearing loss between the allergic rhinitis group and the control group.
- **Pearson correlation** was used to evaluate the relationship between the severity of allergic rhinitis symptoms and the degree of hearing loss.
- **A p-value of < 0.05** was considered statistically significant

RESULTS

Table 1. Demographic and Clinical Characteristics

Parameter	Allergic Rhinitis (Group 1)	Control Group (Group 2)
Total Participants	100	100
Age (Mean ± SD)	32 ± 8	33 ± 7
Gender (Male/Female)	62/38	58/42
Common Allergens	Pollen (45%), Dust mites (35%), Animal dander (20%)	-
Severity of Symptoms	Mild (30%), Moderate (40%), Severe (30%)	-

Table 2. Prevalence of Sensorineural Hearing Loss

Group	SNHL Present (%)	No SNHL (%)
Allergic Rhinitis	28 (28%)	72 (72%)
Control Group	6 (6%)	94 (94%)

Table 3. Degree Of Hearing Loss (Allergic Rhinitis Group)

Degree of SNHL	Number of Patients (%)
Mild SNHL	15 (15%)
Moderate SNHL	8 (8%)
Severe SNHL	5 (5%)

Table 4. Correlation between Severity of Allergic Rhinitis and Hearing Loss

Severity of Allergic Rhinitis	Mean Hearing Loss (dB)	p-value

Mild	25 dB	<0.05
Moderate	35 dB	<0.05
Severe	45 dB	<0.05

The study found that 28% of patients with allergic rhinitis exhibited varying degrees of sensorineural hearing loss, compared to 6% in the control group. A significant correlation was observed between the severity of allergic rhinitis symptoms and the degree of hearing loss ($p < 0.05$). Histamine release and chronic inflammation were identified as potential contributors to cochlear damage.

Pathophysiological Insights

- **Histamine and Cytokines**:

Elevated levels of histamine and cytokines (such as IL-4 and TNF-α) were observed in the serum of patients with allergic rhinitis. These inflammatory mediators are known to contribute to cochlear damage and may disrupt cochlear blood flow, leading to SNHL.

- **Chronic Inflammation**:

Chronic inflammation in the nasal mucosa, when left untreated, may extend to the middle ear and inner ear, potentially leading to cochlear ischemia and damage to the auditory nerve.

DISCUSSION

This study aims to deepen our understanding of the relationship between allergic rhinitis and sensorineural hearing loss. While there is a clear association between allergic rhinitis and conductive hearing loss due to eustachian tube dysfunction and middle ear effusion, sensorineural hearing loss is less well understood.[11-12] Allergic reactions increase vascular permeability, leading to inflammation that could affect the cochlea or the auditory nerve.[13] Allergic inflammation often results in the release of cytokines, which may disrupt cochlear homeostasis and cause inner ear damage.[14] Chronic allergic inflammation may impact autonomic nervous system control, potentially leading to reduced cochlear blood flow and ischemic damage.[15]

CONCLUSION

Allergic rhinitis is associated with a higher incidence of sensorineural hearing loss. Early identification and management of hearing impairment in allergic rhinitis patients may improve long-term auditory outcomes. This study will provide valuable insights into the relationship between allergic rhinitis and sensorineural hearing loss, an area that has not been widely studied. By better understanding how allergic rhinitis can contribute to hearing loss, we can improve diagnostic approaches and develop more effective treatments. In particular, early detection and management of hearing loss in patients with allergic rhinitis could lead to better outcomes and quality of life for those affected.

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