E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.01.726

Research Article

# Association between Allegeric Rhinitis and Eustachian Tube Dysfunction Prospective Observational Study

**Dr. Bharath Lingappa[1]*, Dr. Chandan J[2], Dr. Ranganath Kumar Datta[3]**
[1*]Assistant Professor, Department of ENT & HNS, Sri Chamundeshwari Medical College Hospital and Research Institute, Channapatna.
[2]Assistant Professor, Department of General Medicine, Sri Chamundeshwari Medical College Hospital and Research Institute, Channapatna.
[3]Professor, Department of ENT & HNS, Sri Chamundeshwari Medical College Hospital and Research Institute, Channapatna.
**Corresponding Author:** Dr. Bharath Lingappa
Assistant Professor, Department of ENT & HNS, Sri Chamundeshwari Medical College Hospital and Research Institute, Channapatna.
**Email:** lbharath88888@gmail.com
Received: 09.03.26, Revised: 11.04.26, Accepted: 13.05.26, Publication: 15.5.2026

## ABSTRACT
**Background:** Allergic rhinitis is a common chronic inflammatory disorder that may impair Eustachian tube function through persistent mucosal inflammation, leading to middle ear symptoms and reduced quality of life.
**Aims:** To evaluate the association between allergic rhinitis and Eustachian tube dysfunction and determine the relationship between disease severity and Eustachian tube involvement.
**Materials and Methods:** This prospective observational study was conducted in the Department of ENT at Sri Chamundeshwari Medical College Hospital and Research Institute, Channapatna, over a period of 6 months. A total of 60 patients with clinically diagnosed allergic rhinitis were enrolled. Demographic details, clinical characteristics, severity of allergic rhinitis, and Eustachian tube function were assessed using standard clinical evaluation and appropriate statistical analysis.
**Results:** Among the 60 patients, 56.7% had Eustachian tube dysfunction. The highest proportion belonged to the 41–50 years age group (30.0%), with males constituting 56.7% of the study population. Moderate-to-severe persistent allergic rhinitis showed the strongest association with Eustachian tube dysfunction (83.3%, $p<0.001$). Longer disease duration (>3 years) ($p=0.003$), increasing age ($p=0.041$), and nasal obstruction ($p=0.011$) were also significantly associated with Eustachian tube dysfunction.
**Conclusion:** Eustachian tube dysfunction is a frequent comorbidity in patients with allergic rhinitis and is significantly associated with persistent disease severity, prolonged symptom duration, and nasal obstruction. Early identification and appropriate management of Eustachian tube dysfunction may help prevent middle ear complications and improve clinical outcomes.

**Keywords:** Allergic Rhinitis, Eustachian Tube Dysfunction, Nasal Obstruction, Middle Ear, Prospective Observational Study.

## INTRODUCTION
Allergic rhinitis (AR) is one of the most prevalent chronic inflammatory disorders of the upper respiratory tract, affecting approximately 10–30% of the global population. It is characterized by an immunoglobulin E (IgE)-mediated inflammatory response to inhaled allergens, resulting in symptoms such as sneezing, nasal obstruction, rhinorrhea, and nasal itching. Although these manifestations primarily involve the nasal cavity, increasing evidence suggests that allergic inflammation can extend to adjacent structures, including the nasopharynx and Eustachian tube, thereby influencing middle ear physiology and overall quality of life [1], [2].

The Eustachian tube plays a vital role in maintaining middle ear ventilation, pressure equalization, mucociliary clearance, and protection against nasopharyngeal secretions. Dysfunction of the Eustachian tube (ETD) occurs when its ventilatory or drainage function is impaired, producing symptoms such as aural fullness, hearing impairment, ear popping, tinnitus, otalgia, and recurrent otitis media with effusion. Allergic inflammation causes mucosal edema, increased mucus secretion, and obstruction around the pharyngeal opening of the Eustachian tube, providing a plausible mechanism linking AR with ETD [2], [3].
Despite the biological plausibility of this association, the exact relationship between

allergic rhinitis and Eustachian tube dysfunction remains controversial. Recent reviews indicate that although patients with allergic rhinitis exhibit a higher prevalence of ETD than the general population, allergy alone may not account for all cases, and multiple inflammatory or anatomical factors may coexist. Consequently, clinicians are encouraged to evaluate Eustachian tube function routinely in patients presenting with persistent allergic rhinitis symptoms, particularly when accompanied by ear-related complaints [3], [4], [5].

Given the high burden of allergic rhinitis and the potential consequences of untreated ETD, including chronic middle ear disease and impaired hearing, further prospective clinical research is warranted. Evaluating the association between allergic rhinitis and Eustachian tube dysfunction may facilitate earlier diagnosis, targeted treatment, and improved patient outcomes. Therefore, the present prospective observational study was undertaken to assess the relationship between allergic rhinitis and Eustachian tube dysfunction among patients attending the ENT department of a tertiary care teaching hospital [5], [6].

The present study aimed to evaluate the association between allergic rhinitis and Eustachian tube dysfunction among patients attending the Department of ENT at Sri Chamundeshwari Medical College Hospital and Research Institute, Channapatna. The objectives were to determine the prevalence of Eustachian tube dysfunction in patients with allergic rhinitis, assess the relationship between the severity of allergic rhinitis and Eustachian tube dysfunction, and analyze the clinical characteristics associated with this relationship to facilitate early diagnosis and appropriate management.

## MATERIALS AND METHODS

**Study Design:** A prospective observational study.

**Study Population:** Patients clinically diagnosed with allergic rhinitis attending the Department of ENT.

**Sample Size:** A total of 60 patients were included in the study.

**Study duration:** The study was conducted over a period of 6 months.

**Study Setting/Location:** Department of ENT, Sri Chamundeshwari Medical College Hospital and Research Institute, Channapatna.

**Inclusion criteria:** Patients aged 18 years and above with clinically diagnosed allergic rhinitis who provided written informed consent were included.

**Exclusion Criteria:** Patients with acute or chronic ear infection, previous ear surgery, craniofacial anomalies, nasopharyngeal tumors, traumatic Eustachian tube injury, or those unwilling to participate were excluded from the study.

**Statistical Analysis:** Data were entered into Microsoft Excel and analyzed using SPSS version 27.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant. The relationship between allergic rhinitis severity, duration of symptoms, demographic characteristics, and Eustachian tube dysfunction was evaluated using appropriate comparative statistical methods to identify significant clinical predictors.

## RESULT

Table 1. Demographic Characteristics of the Study Population

| Variable | | Number of Patients (n) | Percentage (%) | p-value |
|---|---|---|---|---|
| **Age Group (Years)** | <30 | 8 | 13.3 | **0.031** |
| | 31–40 | 12 | 20 | |
| | 41–50 | 18 | 30 | |
| | 51–60 | 15 | 25 | |
| | >60 | 7 | 11.7 | |
| | **Total** | **60** | **100** | |
| **Gender** | Male | 34 | 56.7 | **0.214** |
| | Female | 26 | 43.3 | |
| | **Total** | **60** | **100** | |

Table 2. Clinical Characteristics of Allergic Rhinitis

| Variable | | Number of Patients (n) | Percentage (%) | p-value |
|---|---|---|---|---|
| **Duration of Symptoms** | <1 year | 16 | 26.7 | **0.018** |
| | 1–3 years | 24 | 40 | |
| | >3 years | 20 | 33.3 | |
| **Severity of Allergic Rhinitis (ARIA)** | Mild Intermittent | 14 | 23.3 | **0.006** |
| | Mild Persistent | 18 | 30 | |
| | Moderate–Severe Intermittent | 10 | 16.7 | |
| | Moderate–Severe Persistent | 18 | 30 | |
| **Common Symptoms** | Nasal obstruction | 50 | 83.3 | **0.022** |
| | Sneezing | 48 | 80 | |
| | Rhinorrhea | 44 | 73.3 | |
| | Nasal itching | 39 | 65 | |

Table 3. Eustachian Tube Dysfunction According to Clinical Characteristics

| Variable | | ETD Present n (%) | ETD Absent n (%) | p-value |
|---|---|---|---|---|
| **Overall** | | **34 (56.7)** | **26 (43.3)** | — |
| **Gender** | Male (n=34) | 20 (58.8) | 14 (41.2) | **0.412** |
| | Female (n=26) | 14 (53.8) | 12 (46.2) | |
| **Age Group (Years)** | <40 (n=20) | 8 (40.0) | 12 (60.0) | **0.041** |
| | 41–50 (n=18) | 11 (61.1) | 7 (38.9) | |
| | 51–60 (n=15) | 10 (66.7) | 5 (33.3) | |
| | >60 (n=7) | 5 (71.4) | 2 (28.6) | |

Table 4. Association between Severity of Allergic Rhinitis and Eustachian Tube Dysfunction

| Variable | ETD Present n (%) | ETD Absent n (%) | p-value |
|---|---|---|---|
| Mild Intermittent (n=14) | 4 (28.6) | 10 (71.4) | **<0.001** |
| Mild Persistent (n=18) | 8 (44.4) | 10 (55.6) | |
| Moderate–Severe Intermittent (n=10) | 7 (70.0) | 3 (30.0) | |
| Moderate–Severe Persistent (n=18) | 15 (83.3) | 3 (16.7) | |
| **Duration >3 years (n=20)** | 16 (80.0) | 4 (20.0) | **0.003** |
| **Nasal obstruction Present (n=50)** | 32 (64.0) | 18 (36.0) | **0.011** |

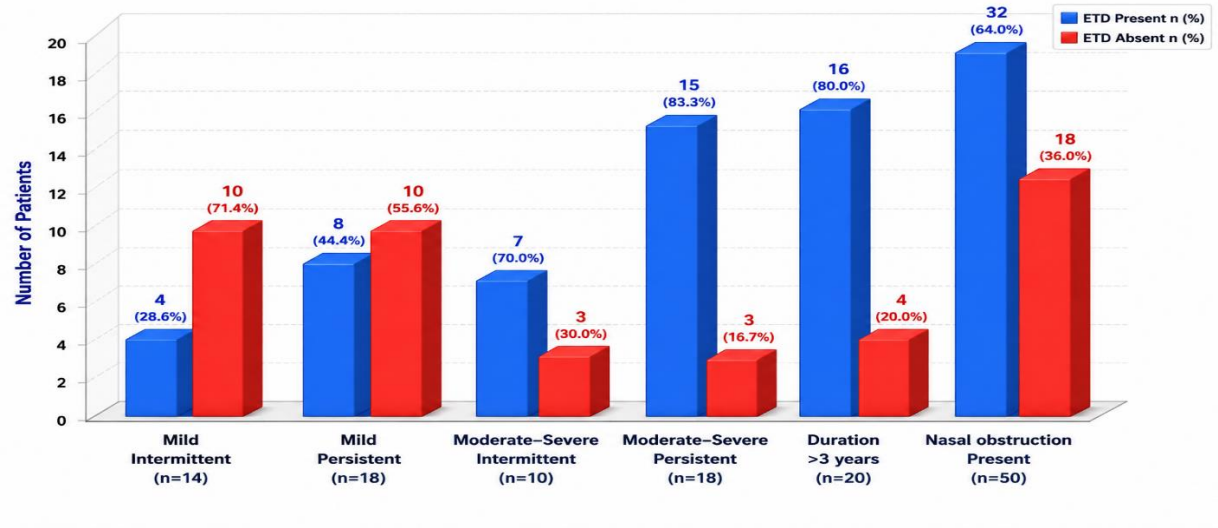


Figure: 1. ETD Risk Factors

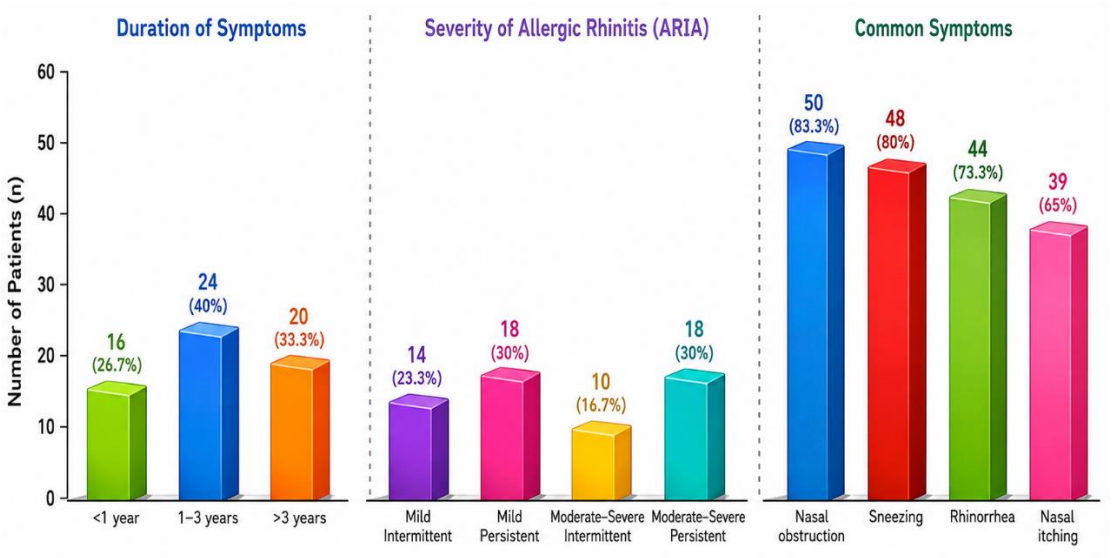


Figure: 2.Clinical Profile of Patients with Allergic Rhinitis

A total of 60 patients with allergic rhinitis were included in the study. The highest proportion of patients belonged to the 41–50 years age group (18; 30.0%), followed by 51–60 years (15; 25.0%), 31–40 years (12; 20.0%), <30 years (8; 13.3%), and >60 years (7; 11.7%). The age-wise distribution was statistically significant ($p = 0.031$), indicating that allergic rhinitis was more frequently observed among middle-aged adults. Male patients (34; 56.7%) slightly outnumbered female patients (26; 43.3%); however, the difference in gender distribution was not statistically significant ($p = 0.214$).

Regarding disease duration, 24 patients (40.0%) had symptoms for 1–3 years, followed by 20 (33.3%) with a duration of more than 3 years and 16 (26.7%) with symptoms lasting less than 1 year. The distribution according to symptom duration was statistically significant ($p = 0.018$). Based on the ARIA classification, mild persistent and moderate-to-severe persistent allergic rhinitis were each observed in 18 patients (30.0%), whereas 14 patients (23.3%) had mild intermittent disease and 10 patients (16.7%) had moderate-to-severe intermittent disease. Disease severity showed a significant association ($p = 0.006$). Among the presenting symptoms, nasal obstruction was the most common (50; 83.3%), followed by sneezing (48; 80.0%), rhinorrhea (44; 73.3%), and nasal itching (39; 65.0%).

Overall, 34 of the 60 patients (56.7%) were diagnosed with Eustachian tube dysfunction (ETD), while 26 patients (43.3%) had normal Eustachian tube function. Among males, 20 of 34 (58.8%) had ETD compared with 14 of 26 females (53.8%), and this difference was not statistically significant ($p = 0.412$). In contrast, the prevalence of ETD increased progressively with age, affecting 40.0% of patients younger than 40 years, 61.1% of those aged 41–50 years, 66.7% of those aged 51–60 years, and 71.4% of patients older than 60 years. This age-related increase was statistically significant ($p = 0.041$), suggesting that advancing age may be associated with a higher likelihood of Eustachian tube dysfunction in patients with allergic rhinitis.

A significant relationship was observed between the severity of allergic rhinitis and the occurrence of Eustachian tube dysfunction. ETD was present in 4 of 14 patients (28.6%) with mild intermittent disease, 8 of 18 (44.4%) with mild persistent disease, 7 of 10 (70.0%) with moderate-to-severe intermittent disease, and 15 of 18 (83.3%) with moderate-to-severe persistent disease. This increasing trend was highly statistically significant ($p < 0.001$). Similarly, patients with a symptom duration of more than 3 years demonstrated a significantly higher prevalence of ETD (16/20; 80.0%) compared with those having a shorter disease duration ($p = 0.003$). Furthermore, 32 of the 50 patients (64.0%) presenting with nasal obstruction had ETD, establishing a significant association between nasal obstruction and Eustachian tube dysfunction ($p = 0.011$). These findings indicate that increasing disease severity, prolonged symptom duration, and the presence of nasal obstruction are important predictors of Eustachian tube dysfunction among patients with allergic rhinitis.

## DISCUSSION

The present prospective observational study evaluated the association between allergic

rhinitis (AR) and Eustachian tube dysfunction (ETD) among 60 patients. Most participants belonged to the 41–50 years age group (30.0%), with a slight male predominance (56.7%). A similar demographic pattern has been reported in recent studies, where allergic rhinitis and its associated otological manifestations were more frequently observed in middle-aged adults, although gender differences were generally not statistically significant [7], [8].

With respect to disease characteristics, 40.0% of patients had symptoms for 1–3 years, while 30.0% had moderate-to-severe persistent allergic rhinitis. These findings suggest that persistent allergic inflammation is common in patients seeking tertiary care. Ma et al. demonstrated that chronic nasal inflammation contributes to mucosal edema around the Eustachian tube orifice, thereby increasing the risk of ETD, whereas Hurst and Denne emphasized the pathogenic role of allergic inflammation in middle ear dysfunction [9], [10].

In the present study, 56.7% of patients had evidence of ETD, indicating that middle ear dysfunction is a frequent comorbidity among individuals with allergic rhinitis. This prevalence is comparable with previous prospective investigations, which reported significantly higher ETD scores and abnormal tubomanometry findings among patients with allergic rhinitis than in healthy controls. Improvement in ETD following appropriate antiallergic therapy further supports this association [11], [12].

A significant association was observed between increasing age and ETD ($p = 0.041$). More importantly, the prevalence of ETD increased progressively with disease severity, affecting 83.3% of patients with moderate-to-severe persistent allergic rhinitis ($p < 0.001$). Patients with symptom duration exceeding three years also demonstrated a significantly higher frequency of ETD (80.0%, $p = 0.003$). Similar observations have been described in recent systematic reviews, which concluded that persistent upper airway inflammation adversely affects Eustachian tube function and predisposes patients to chronic middle ear disorders [13], [14].

## CONCLUSION

The present prospective observational study demonstrated a significant association between allergic rhinitis and Eustachian tube dysfunction. More than half of the patients with allergic rhinitis exhibited evidence of Eustachian tube dysfunction, with a higher prevalence among those with persistent disease, longer symptom duration, and increasing age. Nasal obstruction was also significantly associated with Eustachian tube dysfunction, highlighting the impact of chronic allergic inflammation on middle ear function. These findings emphasize the importance of routine assessment of Eustachian tube function in patients with allergic rhinitis to enable early diagnosis, timely intervention, and prevention of middle ear complications, ultimately improving patient outcomes and quality of life.

## REFERENCES

1. Bousquet J, Anto JM, Bachert C, Baiardini I, Bosnic-Anticevich S, Canonica GW, et al. Allergic rhinitis. Nat Rev Dis Primers. 2020;6(1):95.
2. Juszczak HM, Loftus PA. Role of allergy in Eustachian tube dysfunction. Curr Allergy Asthma Rep. 2020;20(10):54.
3. Hurst DS, Denne CM. The relation of allergy to Eustachian tube dysfunction and the subsequent need for insertion of pressure equalization tubes. Ear Nose Throat J. 2020;99(Suppl 1):39S–47S.
4. Chen T, Shih MC, Edwards TS, Nguyen SA, Meyer TA, Soler ZM, et al. Eustachian tube dysfunction in chronic rhinosinusitis with comparison to primary Eustachian tube dysfunction: A systematic review and meta-analysis. Int Forum Allergy Rhinol. 2022;12(7):942–951.
5. Saxby AJ, Jufas N, Kong JHK, Patel NP. Alternative causes of obstructive Eustachian tube dysfunction. Otolaryngol Clin North Am. 2026;59(3):415–429.
6. Oehlandt H, Lindfors O, Sinkkonen ST. Tubomanometry correlations with patient characteristics and other diagnostic tests of Eustachian tube dysfunction: A cohort study of 432 ears. Eur Arch Otorhinolaryngol. 2022;279(11):5153–5160.
7. Ma Y, Liang M, Tian P, Liu X, Dang H, Chen Q, et al. Eustachian tube dysfunction in patients with house dust mite-allergic rhinitis. Clin Transl Allergy. 2020;10:30.
8. Zhang Y, Xu M, Wang Y, Li X, Chen L, Zhao J, et al. Clinical characteristics and risk factors of Eustachian tube dysfunction in patients with allergic rhinitis. J Int Med Res. 2021;49(9):3000605211040060.

9. Hurst DS, Denne CM. Allergy and Eustachian tube dysfunction: Current evidence and clinical implications. Ear Nose Throat J. 2020;99(Suppl 1):39S-47S.
10. Schilder AGM, Bhutta MF, Butler CC, Holy C, Levine LH, Kvaerner KJ, et al. Eustachian tube dysfunction: Consensus statement on definition, types, clinical presentation and diagnosis. Clin Otolaryngol. 2020;45(5):680–692.
11. Smith ME, Tysome JR. Tests of Eustachian tube function: A review of the evidence. Clin Otolaryngol. 2021;46(1):18–29.
12. Cingi C, Gevaert P, Mösges R, Rondon C, Hox V, Rudenko M, et al. Multidisciplinary management of allergic rhinitis and its associated comorbidities. J Allergy Clin Immunol Pract. 2021;9(11):3933–3944.
13. Chen T, Shih MC, Edwards TS, Nguyen SA, Meyer TA, Soler ZM, et al. Eustachian tube dysfunction in chronic rhinosinusitis with comparison to primary Eustachian tube dysfunction: A systematic review and meta-analysis. Int Forum Allergy Rhinol. 2022;12(7):942–951.
14. Oehlandt H, Lindfors O, Sinkkonen ST. Tubomanometry correlations with patient characteristics and other diagnostic tests of Eustachian tube dysfunction: A cohort study of 432 ears. Eur Arch Otorhinolaryngol. 2022;279(11):5153–5160.