

Effect of Allergic Rhinitis on Eustachian Tube Function and Middle Ear Ventilation

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Abstract:

Introduction: Allergic Rhinitis is considered to be one of the most common diseases affecting a wide range of people barring age. Approximately 20% of adults and children have seasonal or perennial allergic rhinitis. Allergic rhinitis patients often suffer from like asthma, sinusitis, otitis media and decreased hearing. So we decided to do study of eustachian tube function and middle ear ventilation in patients of allergic rhinitis.

Aims: The purpose of this study was to assess the effect of allergic rhinitis on Eustachian tube function (ETF) and middle ear ventilation.

Methods: This prospective study involved 100 Patients so 200 ears were studied. All patients of allergic rhinitis were evaluated on their first visit and assess the impedance tympanometry and Eustachian tube function was done and noted. All Patients were prescribed anti-allergic medication antihistamine and steroids nasal spray as per their liking at first visit. On their second visit after six week of first visit the process was repeated and results were compared.

Results: There was statically significance increase in the proportion of type-A tympanogram cases at first visit was 42 ears [21%] when compared second visit was 176 ears [88%] ($P < 0.05$). At first visit value of middle ear pressure ranged from -150 to 4 daPa, means was -123 and at second visit middle ear pressure was from -75 to 4 and means was -11, with a statically significant improvement in middle ear pressure ($P < 0.05$). Those patients had allergic rhinitis and poor ETF, seen significant improvement ETF at 6 week after anti-allergic treatment. ($P < 0.05$)

Conclusion: We find out that allergic rhinitis has a definite relationship with ETF. Anti-allergic treatment has a favorable effect on the middle ear pressure and ETF.

Keywords: Eustachian tube, allergic rhinitis, middle ear ventilation, impedance tympanometry.

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I. Introduction

Allergic Rhinitis is considered to be one of the most common diseases affecting a wide range of people barring age. Approximately 20% of adults and children have seasonal or perennial allergic rhinitis. [1]. A study carried, over 30 years ago in Delhi reported around 10% allergic rhinitis and 1% asthma in 1964. [2] There after later studies have reported that 20% to 30% of the population suffer from allergic rhinitis and of that 15% develop asthma.

The high prevalence of chronic OME among patients with allergic rhinitis strongly suggests that IgE-mediated allergies are involved in the pathogenesis of middle ear disease. Of the children with allergy, 21% have OME, whereas 50% of children with chronic OME have nasal allergy [3].

The eustachian tube is a dynamic conduit between the middle ear and the nasopharynx with secretory, ciliary, and dilatory functions. The eustachian tube serves to regulate air pressure in the middle ear and mastoid system, clear material from the middle ear, and prevent reflux of material or sound from the nasopharynx [4]

Dysfunction of the Eustachian tube plays a very important role in the pathogenesis of both suppurative and non-suppurative otitis media. Hence, assessment of Eustachian tube function is of paramount importance before any surgery for suppurative otitis media. [5]

The treatment protocol has been varied from time to time with the discovering newer and safer pharmacologic anti-allergic agents. Anti-histaminics and steroidal nasal sprays have been the mainstay in the treatment of allergic rhinitis. Each have their own merits and demerits

The aim of this study was to assess the effect of allergic rhinitis on Eustachian tube function (ETF) and middle ear ventilation by impedance audiometry.

II. Material And Methodology:

This prospective study was carried out in the Department of Otorhinolaryngology Government Medical College Jalaun UP India for a duration of 2 years from November 2016 to November 2018 on 100 patients of age group 16 to 60 years selected on the basis of following criteria

Inclusion criteria:

- Patients with allergic rhinitis coming to Department of ENT, Government Medical college jalaun were included under the study
- All patients received ant allergic medication antihistamine and steroids nasal spray as per their liking at first visit up to minimum second visit at six weeks

Exclusion criteria:

1. Congenital ear or palatal malformation.
2. Otosclerosis and ossicular chain dysfunction as suspected clinically or by pure tone audiometry confirmed by tympanometry
3. History of previous sinus nasal surgery.
4. Patient not willing to follow up
5. Recent history of middle ear infection.
6. Patient with Malignant lesion.

ETF tests in the form of (Valsalva and Toynbee maneuvers) together with tympanometry were performed the at first visit and then repeated at second at six week

Parameters studied:

- Type of tympanogram:- A/B/C
- Middle ear pressure(MEP) in daPa
- Eustachian tube function (ETF) in :-Good/ poor

A detailed history regarding presenting complaints, history of present illness, past history and family history was taken. Systemic disorders like hypertension, tuberculosis and diabetes were ruled out. Examination of Nose and Throat along with general physical and systemic examination was carried out

Equipment:

Zodiac 901 (**Madson-Zodiac 901**,) middle ear analyzer are used

The tympanograms were classified in the standard manner according to **Jerger[6]**.

A tympanogram with middle ear pressure peak between +50 and -100 daPa was classified as **type A**.

Tympanogram with middle ear pressure peak of -100 daPa or more negative was classified as **type C**.

A tympanogram with a flattened peak of less than 0.3 ml admittance was classified as **type B**.

1.Valsalva maneuver

To evaluate the ability to inflate the middle ear actively,

Patients were asked to pinch the nose and inflate the cheeks through forced expiration with the mouth closed until a sensation of fullness was achieved in the ears.

Patients were then instructed to release the nose and refrain from further swallowing or mandibular movement and an experimental tympanogram was obtained in each ear.

A tympanometric peak pressure shift (generally positive) between baseline and experimental tympanogram less than 10 daPa indicated poor ETF, whereas a tympanometric peak pressure[TPP] shift greater than 10 daPa indicated a good ETF.

2.Toynbee maneuver

To evaluate the capacity to equalize the middle ear pressure and the rhinopharyngeal pressure,

Patients were asked to swallow while pinching the nose.

Patients were then instructed to release the nose and refrain from further swallowing and mandibular movement, and an experimental tympanogram was obtained from each ear.

Tympanometric peak pressure [TPP] shift (generally negative) between baseline and experimental tympanogram less than 10 daPa indicated poor ETF,

Whereas a tympanometric peak pressure shift of greater than 10 daPa indicated a good ETF.

ET functions of the ears in which TPP changed by more than ± 10 daPa with the Valsalva and Toynbee maneuvers were accepted as good, and ones in which TPP changed by less than ± 10 daPa were accepted as poor ETF.

Statistical analysis: The statistical package for social science (SPSS) version 20.0 will be used for data analysis. A t-test is used for comparison between the middle ear pressure value by tympanometry at first visit and at second visit. The comparison between at first visit and at second visit ETF tests are performed using the χ^2 -test. Differences will be considered significant when p value will be 0.05 or less.

OBSERVATION AND RESULTS:

In the present study we included 100 patients with 44(44%) males and 56(56%) females, M: F ratio = 1:1.3.(figure-1)The age of the patients ranged from 11 to 60 years, mean age 25 years Majority of the patients were being in the age group of 21-30(35%).(figure-2)

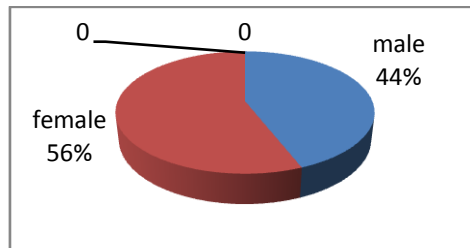


Figure-1 distribution of gender

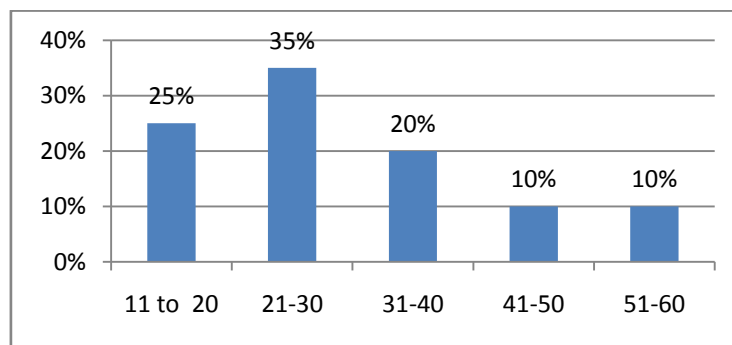


Figure -2 Age group

In this at first visit, 42(21%) ears showed normal type-A Tympanogram while, 158(79%) ears showed abnormal tympanogram out of which 125(62.5%) ears showed type C and 33(16.5%) ear showed type B tympanogram, at second visit (after receiving anti allergic treatment for six week) tympanogram of 176 (88%) were normal type A, while 24(12%) ears showed abnormal curved out of which 5(2.5%) type B and 19 (9.5%) type C curve, There was statically significance increase in the proportion of type A cases at second visit as compared to first visit and P-value $< .05$ as per chi-square test. This shows that allergic treatment after 6 week as evident by statically significant normalization of tympanogram when compared first visit of patients [Table:1]

Table:1

Types of tympanogram at first visit and at second visit

Type	At first visit patients ears[n(%)]	At second visit patientsears[n(%)]
Type-A	42(21%)	176(88%)
Type-C	125(62.5%)	19(9.5%)
Type B	33(16.5%)	5(2.5%)
Total	200(100%)	200(100%)

our study, 62(31%) ears had good Eustachian tube function at first visit, while at second visit after anti allergic medication 160(80%) ears had good Eustachian tube function with increase in proportion of good Eustachian tube function at first visit and at second visit was statically significance (P- value $< .05$), thus those patients had allergic rhinitis and poor ETF, seen significant improvement ETF at 6 week after anti allergic treatment.[Table:2]

Table:2
Eustachian tube function test at first visit and at second visit

Category	Patients ears [n(%)]	
	Poor	Good
At first visit	138(69%)	62(31%)
At second visit	40(20%)	160(80%)

The Effect of allergic rhinitis on the middle ear pressure at first visit and at second visit is shown in **Table:3**, is at first visit value of middle ear pressure ranged from -150 to 4 daPa, means was -123 and at second visit middle ear pressure was from -75 to 4 and means was -11, with a statically significant improvement in middle ear pressure between first visit and at second visit ($P < 0.05$). Thus anti allergic treatment has shown statically significance improvement in middle ear ventilation.

Table: 3
Middle ear pressure at first visit and second visit

Category	At first visit(daPa)	At second visit (daPa)
Range	-150 to 4	-75 to 4
Mean	-123	-11

III. Discussion

Impedance audiometry is a common and practical method that is used for the measurement of middle ear pressure and eustachian tube function.

Three mechanisms were postulated for Eustachian tube dysfunction after nasal disease [7]

First, airflow turbulence may lead to deposition of microorganisms and air pollutants in the region of Eustachian tube opening, resulting in tubal epithelium or peritubal inflammation and mechanical obstruction.

Second, tubal mucous viscosity and surface tension may be increased by the drying effects of altered air currents, leading to increased tubal opening pressure.

The **third** postulated mechanism is that the postnasal mechanical receptors' end on autonomic nerve supply to the Eustachian tube may be stimulated by altered air currents, leading to a reflex alteration in ET

Increased secretions from seromucous glands in the pharyngeal portion of eustachian tube may accumulate and block the tube[.8]. Tubal dysfunction may be related to deficiency of surfactant that is thought to facilitate tubal opening. It has been postulated that this material is inactivated by inflammation.[9]

From the results it can be noted that more number of female patients have reported with AR in our study 44(44%) males and 56(56%) females.**V. M. HemlataKatiyar(1016)**at al also found more number of female patient In their study Among the 111 patients studied 45 were males and 66 were females.[10].However the **Yadav SPS(2001)** shows the incidence of AR to be more in males.[11]

In our study we found **that anti allergic treatment have shown statically significance improvement in middle ear ventilation, Eustachian tube function and propotion of type-A tympanogram cases when compared to from at first visit to second visit.**These results are comparable with study done by**Santosh Mane, PrashantKeche(2016)[12]** They recorded the Eustachian tube function was impaired in 144 of ears (69.24%). Among these 144 ears, 14 were suffering from otitis media with effusion 4 weeks after medical treatment tympanometry showed marked improvement in eustachian tube function. And ears having abnormal tympanograms count reduced to 84 ears (40.39%).

Knight LC, et al in1992[13].They recorded middle ear pressure in 396 ears of seasonal allergic rhinitis patients. Evidence of eustachian tube dysfunction was found in 24% of subjects. Again increased duration of exposure to pollen over a further 2 weeks increased incidence of eustachian tube dysfunction to 48%.

Ashok Murthy V 2013 [14] shows that patients had Type C curve in 30% of the patients on their first visit and subsequently on six to eight weeks of anti-allergy medications the impedance tympanometry showed normal middle ear pressure.

IV. Conclusion:

In our experience medical treatment for allergic rhinitis significantly improves tubal function and middle ear ventilation. Impedance Audiometry is an invaluable tool for evaluation of anatomical patency and functional integrity of Eustachian tube.

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