

A Clinical Study of Need for Tympanostomy Tube Insertion in Allergic Rhinitis Patients with Eustachian Tube Dysfunction

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ABSTRACT

BACKGROUND

Allergic rhinitis also causes dysfunction of Eustachian tube as it can lead to frequent episodes of congestion and production of mucus. We wanted to study the need for ventilating tube insertion in allergic rhinitis patients with dysfunctional Eustachian tube.

METHODS

We studied 200 allergic rhinitis patients and only 30 patients have presented with symptoms related to dysfunction of Eustachian tube which were elicited with the help of history, pure tone audiometry and tympanometry and 20 patients with persistent dysfunction of Eustachian tube even after 3 weeks of conservative treatment with combination of levocetirizine, montelukast and nasal steroid spray for 3 weeks, antibiotics (amoxicillin + clavulanate or cefpodoxime) for 1 week, short term nasal decongestants for 1 week have been chosen for the study while the rest of the 10 patients did not meet the inclusion criteria. These 20 patients underwent myringotomy with tympanostomy tube insertion and postoperatively we have continued antibiotic therapy for another 1 week along with intranasal steroidal spray and levocetirizine & montelukast for 2 weeks.

RESULTS

Patients who underwent myringotomy and tympanostomy tube placement have shown good results. The 20 patients under study have been evaluated again later in 6 months which included history, impedance audiometry, and pure tone audiometry. During the follow up, all the patients under study had undergone thorough physical examination and we noticed that in 2 patients grommet had fallen off around 3 - 4 months while 3 other patients had grommet intact on 6th month follow up as well. Every patient under the study was subjected to audiological examinations. For the ones with intact grommet, they were assessed based on the symptomatic relief and pure tone audiometry but not tympanometry. A definitive improvement has been noticed in 16 patients out of 20. The other 4 patients haven't shown any clinical and audiological improvement. In the age group of 11 - 20 years 3 patients improved and 2 did not improve, in the 21 - 30 years age group 10 patients showed good improvement and in the 31 - 40 years age group 3 patients have shown improvement and 2 patients didn't improve. Data analysis was done with the help of statistical software SPSS version 25, p – value <0.05 was considered as significant.

CONCLUSIONS

Allergic rhinitis patients who are presenting with persistent dysfunction of the Eustachian tube require myringotomy and tympanostomy tube placement along with medical treatment.

KEYWORDS

Allergic Rhinitis, Eustachian Tube Dysfunction, Tympanostomy Tube, Ventilating Tubes, Tympanometry

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BACKGROUND

Rhinitis is a heterogeneous group disorders which is characterized by the following one or more symptoms - rhinorrhoea, itching, sneezing, ear block and nasal congestion. Rhinitis commonly presented by symptoms of the nose, eyes, ears and throat including post nasal discharge.¹ In common language rhinitis is also called as running nose. Allergic rhinitis (AR) is mostly seen in childhood and happens to be the most common chronic allergic disorder seen in children.² 80 % of the cases develops allergic rhinitis symptoms before the age of 20 years. In those families who have a bilateral family history of allergy usually develop symptoms before puberty; but in those children with a unilateral family history tend to have symptoms later in life or not at all.³ Symptoms of AR develop in 1 of 5 children by 2 to 3 years of age and in approximately 40 % by age 6 years. Around 30 % of people develop symptoms in and around adolescence. Additional to these symptoms allergic rhinitis also causes Eustachian tube dysfunction as they can lead to frequent episodes of mucus production and congestion.⁴

Eustachian Tube

The other name for Eustachian tube is pharyngotympanic tube.⁵ Eustachian tube connects the lateral wall of the nasopharynx to the middle ear. It measures about 36 mm in length which consists of bony part 12 mm and cartilaginous part 24 mm. It helps in equalizing the middle ear and atmospheric pressure.

The Eustachian tube functions are as follows⁶

1. Ventilation and Pressure equalization of middle ear.
2. Helps in mucociliary clearance of secretions from middle ear.
3. Middle ear protection from sounds, pathogens and secretions from nasopharynx.

Putting forward a simple way to explain the function of eustachian tube, while a plane takes off as it reaches to higher altitude, the atmospheric pressure drops. Now the drop in the atmospheric pressure creates a force on the tympanic membrane, which in turn expands the volume of the middle ear. Air is then drawn through the Eustachian tube to equalize the middle ear pressure. As the plane descends, the atmospheric pressure is increased, which pushes the tympanic membrane medially, causing compression of air in the middle ear. Similar mechanism is seen in divers. As they descend deeper into the ocean, the hydrostatic pressure increases, similarly to a descending plane.

When there are changes in atmospheric pressure, the Eustachian tube equalizes the pressure in the middle ear. As the eustachian tube is lined by ciliated epithelium, it helps in mucus drainage from middle ear through the tube and also helps in aeration of middle ear.⁷

Two distinct forms of dysfunctions are recognized: 1) Dilatory Eustachian Tubal Dysfunction (DETD), in which tubal opening or patency is reduced, and 2) Patulous Tubal Dysfunction (PETD), in which the ET is too open.⁸ In our

study we are not including patulous ETD. Eustachian tube disorders presents with plugged feeling in ears, watery sensation in ear, pain, tinnitus, hearing loss, trouble with balance.^{8,9}

Middle ear ventilation tubes are placed in the tympanic membrane to help drain accumulated fluid and equalize pressure between the outside atmosphere and the middle ear. Other names for middle ear ventilation tube are pressure equalizing tube (P.E. tubes), tympanostomy tubes, ventilation tubes or myringotomy tubes. Some of the indications for tympanostomy tube placement are:

- Recurrent ear infections, greater than four or five bouts per year.
- Fluid in the middle ear which doesn't clear in a six to twelve week period.
- Infection which doesn't clear up with antibiotic treatment.
- Severely retracted ear drums.

The procedure for placement of ventilating tube is, clean the ear, make a small incision in the anterior inferior part of tympanic membrane with the help of myringotomy knife, suction the fluid out and carefully place the tube in position. Tympanostomy tube is placed to keep the middle ear ventilated for prolong period of time. Tympanostomy tubes come in various sizes, make sure to choose the right size of the tube. They are hardly any complications noted with the procedure, but few noted ones are like faulty technique leading to difficulty in placement of tube, haemorrhage, extrusion of tube, infection caused with the tube in place, foreign body tube.

Objectives

1. to assess allergic rhinitis patients with Eustachian tube dysfunction.
2. to study the need for tympanostomy tube insertion in allergic rhinitis patients with Eustachian tube dysfunction.

METHODS

The present descriptive study was conducted from 2018 October to 2019 December. All the patients attending to our outpatient department with allergic rhinitis and symptoms of Eustachian tube dysfunction such as blocked ear, heavy ear, reduced hearing have been chosen for this study. Every patient underwent detailed history taking, thorough examination and detailed investigations such as complete blood picture with absolute eosinophil count, pure tone audiometry and impedance audiometry. Those Patients who showed conductive deafness on pure tone audiometry (PTA) and 'B' or 'C' type of curve on tympanometry were included in the study. PTA in all patients showed between 30 to 40 dB loss. Sample size was calculated by using formula $n = 4pq / ME$ (Marginal Error). Before starting the study we have taken an approval from the ethical committee and consent from the patients.

A group of 20 patients have been chosen finally for the study from which males were 10 (50 %) out of which 2 patients belong to age group of 11 - 20, 5 patients to 21 - 30 and 3 patients to 31 - 40 and 10 (50 %) female patients out of which 3 belong to 11 - 20 age group, 5 to 21 - 30 age group and 2 to 31 - 40 age group.

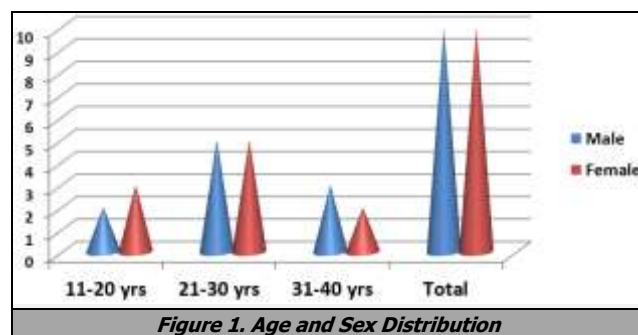


Figure 1. Age and Sex Distribution

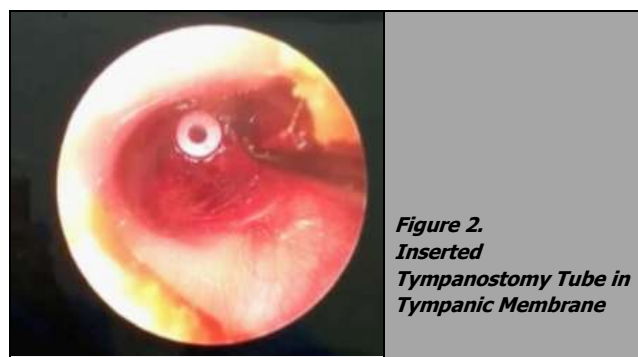


Figure 2.
Inserted
Tympanostomy Tube in
Tympanic Membrane

Inclusion Criteria

1. Patients with allergic rhinitis who came with symptoms of persistent Eustachian tube dysfunction after 3 weeks of medical treatment.
2. Patients of age 11 to 40 yrs.

Exclusion Criteria

1. Patients under age of 11 years and above 40 years.
2. Patients with any co morbidities.
3. Patients with associated disorders such as adenoids, polyps etc.
4. Patients who underwent previous ear surgeries.
5. Patients who are frequent travelers and divers.

The 30 patients who were complaining symptoms of Eustachian tube dysfunction were put on the allergic rhinitis treatment and conservative treatment for dysfunction of Eustachian tube symptoms. The treatment that was given to these patients included a combination of levocetirizine and montelukast and nasal steroid spray for 3 weeks, antibiotics (amoxicillin + clavulanate or cefpodoxime) for 1 week, short term nasal decongestants and steam inhalation for 1 week. But sadly, 20 out of these 30 patients showed no improvement with the treatment. These 20 patients had to undergo myringotomy and tympanostomy tube insertion (Figure 2). These patients were on close watch post-operatively and continued antibiotic therapy for another 1 week along with intranasal steroidal spray and levocetirizine

& montelukast for 2 weeks. The clinical assessment of the treatment has been reviewed again in 6 months with history, pure tone audiometry and impedance audiometry. During this period of 6 months the patients were under regular follow up.

RESULTS

Patients who underwent myringotomy and tympanostomy tube placement have shown very good results. The 20 patients who were under our study have been called and evaluated again later in 6 months which included thorough history, clinical examination, investigations such as pure tone audiometry and impedance audiometry. During the follow up all the patients under study had undergone thorough physical examination and we noticed in 2 patients grommet had fallen around 3 - 4 months and 3 patients had grommet intact on 6th month follow up as well. Every patient under the study was subjected to audiological examinations but for the ones with intact grommet we did pure tone audiometry only. A definitive improvement in terms of symptomatic improvement as well as improvement in audiological tests has been noticed in 16 patients out of 20. The other 4 patients haven't shown any improvement (these patients still had the same complaints of blocked ears, hard of hearing etc. and no improvement was seen in audiometric studies) and even one patient developed ear infection. In 3 patients with intact grommet we didn't perform tympanometry, but they were evaluated based on pure tone audiometry and the symptoms whether they were relived or not.

Age Group	Good Improvement	Moderate Improvement	Total	Poor Improvement	No Improvement	Total
11-20 years	2	1	3	2	0	2
21-30 years	8	2	10	0	0	0
31-40 years	3	0	3	1	1	2
Total	13	3	16	3	1	4
Table 1. Results of Different Age Groups						
p Value = 0.0433 < 0.05. So significant at 5 % level of significance (Fisher Exact test)						

The auditory gain of 15 to 20 dB on PTA is considered as "Good Improvement". 10 to 14 dB gain: "moderate improvement". 5 to 9 dB; "poor improvement". No change: "No improvement". We considered good improvement and moderate improvement are as "Improved" and poor improvement and no improvement are as "Not improved" (Table 1). The results are as follows from age group of 11 - 20 '3' patients improved and '2' showed no improvement, 21 - 30 age group all the '10' patients have shown good improvement and from 31 - 40 age group '3' patients have shown improvement and '2' patients didn't improve. As per the male to female ratio out of 10 males '7' males have shown good improvement and '3' didn't respond and in

females '9' patients have shown improvement and '1' patient has shown no improvement. Collected Data entered in the Microsoft excel 2010 for further analysis, Qualitative data has presented with frequency and - proportion and Fisher Exact test applied to see the difference between the proportion, analysis has done with the help of statistical software SPSS version 25, p - Value<0.05 was considered as significant.

DISCUSSION

Eustachian tube is a musculo-cartilaginous tube which connects middle ear and nasopharynx. This tube helps in the middle ear pressure equalization and helps in draining the secretions from the middle ear. For diagnosis of an eustachian tube dysfunction, the patients must present with symptoms like discomfort / pain, aural fullness or with symptoms of pressure disequilibrium. Patients may also complain of ringing, pressure, autophony clogged and muffled hearing.

Allergic rhinitis causes epithelial dysfunction, alters the air flow, increases mucus secretions and all these affects the Eustachian tube which leads to eustachian tube dysfunction. These heavy secretions form a mucus plug which leads to alteration in the pressure in eustachian tube and middle ear, causing inflammation in and around eustachian tube and also prevents the secretions from draining into nasopharynx.

There are various studies done on eustachian tube and its relation to allergic rhinitis. A study done in 2015 on eustachian tube dysfunction states that "Acute dilatory eustachian tube dysfunction is often followed by upper respiratory tract infection, or few of the times by exacerbation of allergic rhinitis, which presumed to cause inflation in the eustachian tube lumen or orifice."⁸

Another randomized controlled trial study was done in 2018 on effectiveness of using balloon dilation as a choice of treatment or as an option of treatment for persistent Eustachian tube dysfunction. This study randomly chooses 60 patients who underwent balloon dilatation for eustachian tube dysfunction who were under follow up for 1 year and found this treatment to be very effective. "Balloon dilation is superior as compared to continued medical management for persistent dysfunction of Eustachian tube. Symptom improvement is long lasting through a minimum of 12 months. Procedures are well tolerated in the day care setting under local anaesthesia."¹⁰

A study done similar to this with an objective to assess the function of Eustachian tube in allergic rhinitis patients and compared them with a control group also stated that "patients with allergic rhinitis have a higher risk of eustachian tube dysfunction, especially during childhood. Tympanometry is a noninvasive, readily available procedure that may be useful to detect ETD which will help in preventing chronic middle ear disease in these patients".¹¹

Not all studies done are in favour of this theory. One study where the relation of allergic rhinitis with Eustachian was done showed unfavourable results. Their study

concludes that allergic rhinitis has no relation to eustachian tube dysfunction. "The prevalence of allergic rhinitis in children with Otitis media with effusion (28.4 %) and control subjects (24.1 %) did not differ significantly, and also no differences in total eosinophil count, serum and middle ear effusion IgE concentration in these 2 groups showed. Eustachian tube function abnormalities were the same in controls and in allergic rhinitis patients."¹²

Our study here shows that patients with allergic rhinitis have the tendency to develop eustachian tube dysfunction which will further require the placement of tympanostomy tubes and those patients who underwent myringotomy with tympanostomy tube placement along with allergic rhinitis medical treatment have shown good results.

CONCLUSIONS

Allergic rhinitis affects the Eustachian tube causing Eustachian tube dysfunction and presents with symptoms such as blocked ear, pain, tinnitus, fluid or heaviness in ear or reduced hearing due to excess mucus production forming a plug. These patients require insertion of a tympanostomy tube to relieve the symptoms and improve the hearing along with treatment of allergic rhinitis.

Financial or Other Competing Interests: None.

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