

## Original Research Article

# Impact of adenotonsillectomy on hearing profile of children with chronic middle ear effusion

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## ABSTRACT

**Background:** Chronic middle ear effusion (CME) also known as otitis media with effusion (OME)/glue ear/secretory otitis media is the commonest cause of hearing loss in children, characterized by presence of sterile serous fluid within the middle ear, causing temporary and reversible hearing loss. The aim of present investigation was to determine the effect of adenotonsillectomy on hearing profile of children with persistent OME.

**Methods:** This prospective study was conducted in the Department of ENT, Aarupadai Veedu Medical College, Pondicherry during the period of June 2014 to February 2016. 50 children, between the age group of 3-12 years, with features suggestive of OME, and adenotonsillar hypertrophy that underwent adenotonsillectomy during the study period was included in this study. Demographic details and clinical features were collected from the participants. Hearing evaluation was performed by pure tone audiometry (PTA) and tympanometry preoperatively at time of diagnosis and postoperatively at 6 weeks and 3 months after adenotonsillectomy. Data collected was plotted into master chart and analysed using paired t-test and chi square test to determine the improvement in hearing after 6 weeks and 3 months following surgery.

**Results:** 46 children aged between 3 and 12 years with a mean age of 5.3 and standard deviation of 2.2 years. OME was most prevalent in age group was 5-7 years (34.78%) followed by 7-9 years (30.43%). There were 26 (56.52%) males and 20 (43.47%) females. Pre-operatively most of the subjects were having moderate conductive hearing loss (between 26dB to 40dB) with a mean hearing loss of 34.2dB and a standard deviation of 12.2dB. At 6 weeks postoperatively, hearing loss of children were within 16-25dB with a mean loss of 21.6dB and a standard deviation of 6.4dB. At 3 months postoperatively, 30 children were having only minimal hearing loss and 8 were having mild hearing loss.

**Conclusions:** CME is a common cause of childhood hearing loss having a long-term sequel affecting the language development of the child. Adenoidectomy can improve the middle ear function and the hearing profile of child and can be considered as a practical management option in children with chronic adenotonsillar hypertrophy with established otitis media with effusion.

**Keywords:** Adenoidectomy, Hearing loss, Otitis media

## INTRODUCTION

Otitis media with effusion (OME) is an inflammatory disorder of the middle ear, characterized by the

accumulation of serous fluid within middle ear and sometimes within mastoid air cells, without any signs or symptom of acute ear infection.<sup>1</sup> OME is a highly common pediatric disease (can affect adults also) that is often wrongly considered to be benign or harmless.

However, it has been widely demonstrated that OME has both short- and long-term impacts on audition, language, cognitive development and quality of life in children.<sup>1-3</sup> Globally it is estimated that up to 90% of children experience at least one episode of OME before reaching school age (60% of the episodes occur in the first 2 years of life).<sup>1,2</sup>

OME is usually self-limited, and the fluid generally resolves on its own within 4 to 6 weeks (<30% in children aged <4 years).<sup>3</sup> Most of the times, medical treatment is found to be ineffective to provide a cure and hence surgery, which may take the form of myringotomy and ventilation tube / grommet insertion with or without adenoidectomy is considered as treatment of choice in children with persistent OME.

Children with OME usually presents with inattentiveness, poor scholastic performance, slow learning and occasionally with recurrent otalgia when secondary infection happens.<sup>4</sup> Clinical findings in otoscopy includes retracted and dull tympanic membrane with restricted mobility on siegalisation, presence of air fluid level and/or air bubbles behind the drum etc. Audiometry may show conductive hearing loss, with tympanometry showing a typical type B tympanogram. Chronic hypertrophy of adenoids and tonsils leading to dysfunction of Eustachian tubes (ET) are the most common cause of OME in children.<sup>4</sup>

This study was conducted with a precise objective to evaluate the effect of adenotonsillectomy in hearing profile of children with persistent otitis media.

## METHODS

This prospective study was conducted in the Department of ENT, Aarupadai Veedu Medical College, Pondicherry during the period of June 2014 to February 2016. 50 consecutive children of both genders were included in this study. The study was approved by institutional ethics committee and informed consents were obtained from the parents.

### Inclusion criteria

- children of both genders
- between the age group of 3 - 12 years
- with clinical features suggestive of OME, and adenotonsillar hypertrophy that underwent adenotonsillectomy during the study period.

### Exclusion criteria

- Children with history of previous adenotonsillectomy, having acute respiratory tract infections, septal deviations, nasal polyps,
- Children with anatomic abnormalities like cleft palate, syndromic children, with complaints or

findings of discharging ear or tympanic membrane perforation

- Children with previous ear or palatal surgery or those with mental retardation
- Parents of children who were not willing to enroll for study.

Structured questionnaires were administered to parents or caregivers to collect the demographic data and clinical information about presence or absence of symptoms of OME and adenotonsillar hypertrophy.

Clinical examination was done. Otoscopy was performed to view the condition of the tympanic membrane at time of presentation, audiological evaluation was done by PTA and tympanometry to establish diagnosis of OME. Tympanometric curve results were classified according to modified Jerger's classification as types A, as, B or C.<sup>5</sup> Type A and C curves were interpreted as no middle ear effusion while type B and as predictive of middle ear effusion. Children who were having no hearing loss and/or a non B type of tympanometry curve were also excluded from the study. The tonsil sizes of patients were noted and graded according to the Brodsky grading scale.<sup>6</sup> Digital X-ray nasopharynx lateral view in erect position was done to confirm adenoid hypertrophy and to grade them as per guidelines provided by Fujioka et al.<sup>7</sup> All the patients underwent adenotonsillectomy under general anesthesia by classical curette method. The children were followed up after surgery at 6 weeks and 3 months with PTA and tympanometry to re-assess the hearing profile.

Data collected were plotted into spreadsheets and statistical analysis was performed with SPSS software (SPSS 16.0, SPSS Inc, Chicago, IL). Paired t-test and chi square test was performed to determine the change in hearing profile after 6 weeks and 3 months following surgery. A value of  $p < 0.05$  was considered statistically significant.

## RESULTS

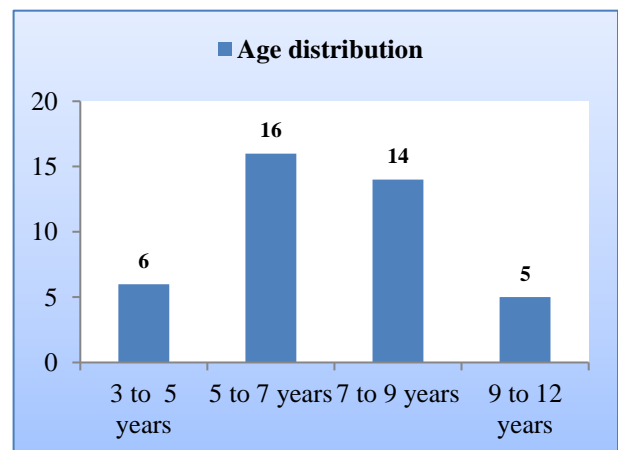
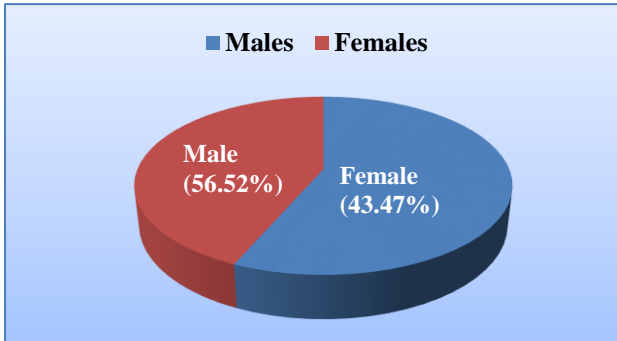


Figure 1: Age distribution of study population.

After applying the exclusion criteria, a total of 46 patients were evaluated. They aged between 3 and 12 years with a mean age of 5.3 and standard deviation of 2.2 years. The most prevalent age group was 5-7 years (34.78%) followed by 7-9 years (30.43%) (Figure 1). There were 26 (56.52%) males and 20 (43.47%) females (Figure 2).



**Figure 2: Gender distribution of study population.**

Most children presented with more than one symptom. It was observed that 91.30% presented with mouth breathing and 86.95% presented with nasal obstruction, which were the commonest symptoms. Other symptoms were recurrent cold, snoring, ear block, suspected hard of hearing and recurrent sore throat (Table 1).

**Table 1: Symptom profile of study population.**

Symptoms	No. of patients	Percent
Mouth breathing	42	91.30
Nasal obstruction	40	86.95
Snoring	35	76.08
Recurrent cold	33	71.73
Recurrent sore throat	28	60.86
Hard of hearing	16	34.78
Ear ache	9	19.56

Otosopic findings showed dull and retracted tympanic membrane in 36 children (78.26%). Classical amber colored tympanic membrane with air fluid level was observed in 16 children (34.78%). While doing pneumatic otoscopy, movement could be observed only in 6 children (13.04%) and the in rest 40 children (86.95%) no movement of tympanic membrane could be appreciated.

Adenotonsillectomy was performed under general anesthesia by classical curette method for all the subjects with endoscopic visualization.

The resolution of OME was assessed by PTA and tympanometry at 6 weeks and 3 months interval. Chi-square test revealed a good prognosis for OME at 6 weeks and 3 months after surgery in both ears separately. It was observed that, there was a significant improvement ( $p < 0.05$ ) in hearing of children at 6 weeks and 3 months postoperatively.

The pre-operative audiogram demonstrated that most of the subjects were having moderate conductive hearing loss (between 26dB to 40dB) with a mean hearing loss of 34.2dB and a standard deviation of 12.2dB. The maximum hearing loss was 48dB while the minimum was 21.2dB, when both ears were considered together. At 6 weeks postoperatively, hearing loss of majority of children were within 16-25dB with a mean loss of 21.6dB and a standard deviation of 6.4dB. At 3 months postoperatively, 30 children were having only minimal hearing loss and 8 were having mild hearing loss. Those children who were having moderate hearing loss at 3 months were having a pre-operative hearing loss of above 40dB (Table 2).

**Table 2: Degree of hearing deficit - preoperative, post op 6 weeks and post op 3 months.**

Degree of hearing loss	Pre-Op	Post-Op 6 weeks	Post-Op 3 months
0-15dB	0	11	30
16-25dB	6	22	11
26-40dB	34	12	4
41-55dB	6	1	1
56-70dB	0	0	0
71-90dB	0	0	0
>90dB	0	0	0
<b>Inter group difference</b>			
Pre-Op Vs	-	p = 0.038	p = 0.014
Post op 6 weeks vs	-	-	p = 0.028

**DISCUSSION**

Chronic middle ear effusion, a term synonymous with otitis media with effusion, secretory otitis media, serous otitis media and glue ear is one of the chronic otological conditions of childhood. The pathology of condition is alteration of mucociliary system in the middle ear cleft usually caused by malfunction of the Eustachian tube. Eustachian tube dysfunction leads to negative pressure inside middle ear causing accumulation of serous or mucoid fluid within the tympanic cavity.<sup>8</sup>

Chronic hypertrophy of adenoids is the most common cause of Eustachian tube dysfunction in children, causing otitis media with effusion. Adenoid hypertrophy can produce Eustachian tube obstruction in two ways. Direct mechanical obstruction of ET by enlarged adenoids and the obstruction of lymphatics draining the middle ear and ET are the two mechanisms postulated. Chronic infection of adenoids acts as a focus of infection adjacent to ET orifice causing retrograde infection and tubal dysfunction.<sup>4</sup>

In present study majority of children were in the age group 4-6 years followed by the 7-9 years group. This observation can be explained by the results from a study of Fujioaka et al. They found that the size of the adenoids,

though varies from child to child, attain their maximum size between 4-8 years of age after which it then regresses gradually till the age of 12 years.<sup>6</sup> The peak age incidence for middle ear effusions correspond to the period of maximum lymphoid hyperplasia in the nasopharynx.<sup>8</sup>

In present study it was observed that male children were having more incidence of OME than female children. Male sex, aboriginal status, lack of breastfeeding, older siblings, daycare, passive smoke exposure and low socioeconomic status have consistently been identified as risk factors for OME. Male children have more incidence of childhood infection as they are more exposed to allergic and infectious agents compared to female children.<sup>9-11</sup>

The classical presentation of chronic adenoid hypertrophy is mouth breathing, snoring, nasal obstruction and recurrent cold. In present study also, nasal symptoms were the most common complaints. Mouth breathing was observed in 91.30% cases, nasal obstruction in 86.95%, snoring in 76.08% and recurrent cold in 71.73% children. Ear symptoms of hard of hearing and ear ache were presented in 34.78% and earache in 19.56% respectively. Nasal symptoms were predominated over aural symptoms maybe because the parents identify nasal symptoms more easily compared to aural symptoms secondary to adenoids.

78.26% percent of children were having a dull and retracted tympanic membrane on otoscopy, while 34.78% was having the classical amber colored tympanic membrane with air fluid level. Movement of tympanic membrane could be observed in 13.04% on pneumatization while in the rest 86.95% no movement could be appreciated, which is a reliable sign of OME. According to Agency for health care research and quality otoscopic appearance is reliable in two-third cases of OME.<sup>14</sup> In another study done at Howler medical university in Erbil, Iraq it was found that the most common type of tympanometry results seen among the children with otitis media was type B.<sup>15</sup>

Moideen et al has concluded in their study that Lateral neck X-ray with calculation of adenoid-to-nasopharynx ratio is found to have significant correlation with patient reported symptoms and findings in nasal endoscopic examination. They also reported that lateral neck x-ray can be considered as a useful objective tool in evaluation of children with adenoid hypertrophy.<sup>16</sup> Radiologically, most of the children (64.3%) in our study were having a grade 3 adenoid hypertrophy. Results from previous studies have suggested a positive correlation between grades of adenoids hypertrophy, the descendent degree of middle ear function and the incidence of OME.<sup>17</sup>

Authors observed a significant improvement in OME post operatively as suggested by PTA values and tympanometry. Postoperatively the mean hearing loss

was 21.6±6.4dB at 6 weeks, which then dropped to 12.3±4.2dB at 3 months. 65.21% of children were having complete resolution of OME (suggested by type A tympanogram) at the end of 3 months. These results were correlating well with results of similar independent studies conducted by Richard and Ajayan, where rate of resolution was 62% and 66% at the end of 3 months respectively.<sup>18,19</sup>

34.78% of children were having a persistent hearing loss at the end of 3 months. In the study by Ajayan, 25.71% of children were having persistent hearing deficit at 3 months.<sup>19</sup> The persistent deficit may be a consequence of long standing OME or may be due to other unaddressed causes of OME like allergy or ciliary dysfunction. Due to this rationale, it is better to do an early surgical intervention to prevent unwanted sequel of rather than having a wait and watch policy.

Present study has shown that hearing deficit due to OME is very common among children with adenoid hypertrophy and adenotonsillectomy will provide them with a good improvement in terms of symptoms and hearing profile. Similar study conducted by Sandooja et al about the effect of adenotonsillectomy on hearing threshold and middle ear pressure concluded that adenoidectomy improves Eustachian tube function which was same as our conclusion.<sup>20</sup>

Development of OME hampers language learning in the early years of life, which is important in the formative years for the normal functioning of a child in his community.<sup>21,22</sup> OME if identified and treated in the early stages itself, can prevent the long-term sequel and may help the child with a better language learning and scholastic performance.

## CONCLUSION

Chronic middle ear effusion is a common cause of childhood hearing loss. Though generally considered to be a harmless illness, the long-term sequel of OME is very terrible as it affects the language development of the child. Adenoidectomy can improve the middle ear function and the hearing profile of child. Adenoidectomy can be considered as a practical management option in children with chronic adenotonsillar hypertrophy with established otitis media with effusion.

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