Original Research Article

Adenoid hypertrophy- Prevalence of otitis media with effusion and effect on hearing thresholds in children

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Abstract

Background: Otitis media with effusion (OME) is the accumulation of mucus within the middle ear and sometimes the mastoid air cell system. In children, OME may present with hearing loss, delayed speech and language development, poor social behaviour and reduced school performance. The adenoid is a mass of mucosa associated lymphoid tissue located in the roof and posterior wall of the nasopharynx. **Aim:** To determine the prevalence of middle ear effusion in children with adenoid hypertrophy and compare the grade of adenoid hypertrophy with the severity of hearing loss. **Methodology:** The study was performed in the Department of ENT, Pondicherry Institute of Medical sciences. 100 Children aged 3–15 years diagnosed to have adenoid hypertrophy based on clinical features were included in the study. Nasal endoscopy was performed to assess the status of adenoids and the findings were documented. All subjects with or without symptoms of hearing loss were subjected to routine otoscopic examination and hearing assessment by standard pure tone audiometry (PTA) and impedance testing. The values were documented. **Results:** A total of 100 children diagnosed with OME were included in the study. Majority of patients between the ages of 3-15 years were males. 46% had adenoidal symptoms between the age group of 3-5 years. Nasal obstruction (41%), mouth breathing (35%) and snoring (39%) were the common symptoms followed by hard of hearing and aural fullness. Majority of the patients had grade 2 (26%) adenoid enlargement followed by grade 3 (21%). Most children had B type (58%), 35% had A type curve on tympanometry. 8 out of 26 patients with Grade 2 adenoid hypertrophy and & 7 out of 21 patients with Grade 3 hypertrophy had no hearing loss. **Conclusion:** We have concluded that adenoid hypertrophy has significant effect on the development of otitis media with effusion, but size of adenoids has no effect on the severity of hearing loss and tympanometry findings. It is necessary to do a hearing assessment in children with adenoid hypertrophy as hearing loss due to development of OME can be missed leading to problems with speech and language development and poor scholastic performance.

Key Word: Adenoid hypertrophy.

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INTRODUCTION

Otitis media with effusion (OME) is the accumulation of mucus within the middle ear and sometimes the mastoid air cell system.[1] Approximately 80% of all children will have had a single episode of OME before the age of 3 years and 40% will have three or more episodes.[2] The overall prevalence rate varies between 4% and 20%.[3] In children, OME may present with hearing loss, delayed speech and language development, poor social behaviour and reduced school performance. Inflammation and infection of the adenoid with resultant hypertrophy is one of the most common causes of OME in children. The adenoid is a mass of mucosa associated lymphoid tissue located in the roof and posterior wall of the nasopharynx. The adenoids are a part of Waldeyer's ring of lymphatic tissue and is prominent in children but generally atrophies after puberty. The proximity of the adenoids to the eustachian tube is the

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cause for spread of infection from nasopharynx to middle ear. Enlarged adenoids can cause mechanical obstruction to the eustachian tube. The eustachian tube provides an anatomical connection between the nasopharynx and the middle ear. The Eustachian tube and anterior mesotympanum are lined by ciliated, pseudostratified columnar respiratory epithelium. The mucosa contains both goblet cells and mucus-secreting glands.[4] In normal tubal function, intermittent opening of the eustachian tube maintains the pressure of the middle ear. Blockage of the eustachian tube opening in the nasopharynx by enlarged adenoids, creates a high negative pressure in the middle ear.[5,6] This persistent eustachian tube obstruction with poor ventilation of the middle ear, causes prolonged inflammation of the middle ear mucosa leading to cell differentiation and increase in the number of mucus cells and production of a serous or mucus effusion. Mucus trapped in the eustachian tube induces an upstream pressure drop in the middle ear, which in turn prevents the mucus from being evacuated resulting in a 'glue ear'.

AIM: To determine the prevalence of middle ear effusion in children with adenoid hypertrophy and compare the grade of adenoid hypertrophy with the severity of hearing loss**.**

MATERIALS AND METHODS

The study was performed in the Department of ENT, Pondicherry Institute of Medical sciences. The study was carried out in accordance with the ethical regulations and it was approved by the Ethics Committee of the same institution. 100 Children aged 3–15 years diagnosed to have adenoid hypertrophy based on clinical features were included in the study. History of nasal obstruction, mouth breathing, snoring, aural fullness, hard of hearing, recurrent URTI and ear pain were elicited. Children with clinical evidence of chronic suppurative ear disease, any other associated syndromic conditions, previous conservative treatment for adenoid enlargement were excluded from the study. Each patient was assigned a unique study number. An informed consent was obtained from all the participants. Nasal endoscopy was performed to assess the status of adenoids and the findings were documented. Four groups were formed according to the size of the adenoids as follows: 0–25% as Group 1, 26–50% as Group 2, 51–75% as Group 3 and 76–100% as Group 4. All subjects with or without symptoms of hearing loss were subjected to routine otoscopic examination and hearing assessment by standard pure tone audiometry (PTA) and impedance testing. The values were documented. In the very young, VRA / BERA was done, if PTA was inconclusive. The statistical relationship between the size of adenoid tissue and the hearing thresholds was investigated. Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) Statistics version 23. Descriptive analysis was done using a chi-square test and T test. P value < 0.05 was considered statistically significant.

RESULTS

A total of 100 children diagnosed with OME were included in the study. Among these, majority of patients between age of 3-15 years, were males (61%) (Table 1). The reason behind male preponderance is unknown. 46% had adenoidal symptoms between the age group of 3-5 years. The prevalence sharply decreased with age. In this study, nasal obstruction (41%), mouth breathing (35%) and snoring (39%) were the common symptoms followed by hard of hearing and aural fullness (Table 2). Majority of the patients had grade 2 (26%) adenoid enlargement followed by grade 3 (21%) (Table 3).

Table 1: Age- sex distribution

Age	male	female
3-5 yr	35	11
6-9 yr	17	18
10-15yr	9	10

Table 2: Distribution of Symptoms

Symptoms	Number of Patients	Percentage
Nasal Obstruction	41	41
Mouth Breathing	35	35
Snoring	39	39
Aural fullness	26	26
Hard of hearing	30	30
Recurrent UTI	3	3
Ear pain	9	9

Nasal obstruction >hard of hearing > aural fullness

Table 3: Grades of Adenoids using Diagnostic nasal endoscopy

Grade	Total
Grade 1	16
Grade 2	37
Grade 3	36
Grade 4	11

Tympanometry showed a `B'type curve in 58% of the patients while 35% had an `A' type curve. There was no significant statistical association between adenoid size (p value >0.05) and the distribution of tympanometry curve (Table 4).

Table 4: Distribution on tympanometry curve

Curve type	Number of patients	Percentage
A	35	35
B	58	58
C	7	7

Table 5: Size of adenoid hypertrophy and severity of hearing loss

Grade	Normal	Mild CHL	Moderate	Moderately/ severe	Total
Grade 1	13	3	0	0	16
Grade 2	9	14	13	1	37
Grade 3	9	12	14	1	36
Grade 4	4	3	2	2	11

There is statistically no significant association between adenoid size (p value <0.05) and the severity of hearing loss but is clinically significant. Tympanic membrane in otitis media with effusion shows a dull and retracted tympanic membrane with apparent foreshortening of the handle of malleus and the mobility of the tympanic membrane will be restricted. Chronic otitis media with effusion is most easily confirmed when there are air fluid levels and presence of bubbles seen on otoscopic examination. In our study 43% had dull and retracted tympanic membrane and 22% had fluid with air bubbles on otoscopic examination (Table 6), thereby clearly establishing that the presence of adenoid hypertrophy has a direct influence on the ventilation and drainage of the middle ear cleft and the consequent development of otitis media with effusion, though the size of the adenoid did not have a statistical association with the otoscopy findings.

Table 6: Otoscopy findings

Tympanic membrane	Number of patients	Percentage
Intact	35	35
Dull and retracted	43	43
Fluid with air bubbles	22	22

DISCUSSION

OME and adenoid hypertrophy are common causes of morbidity in childhood. Viral infections, bacterial colonization and biofilm formation, allergy and immunological factors can contribute to the development of OME.[7,8,9] Functional and mechanical obstruction to the eustachian tube play a major role in the development of OME. The most frequent and common cause for extrinsic mechanical obstruction in children is adenoid hypertrophy. Hearing loss due to OME in children is frequently missed. Diagnosis of OME goes often unnoticed by routine ear examination including otoscopy especially in children without complaints of hearing loss.[10] Adenoid enlargement should be suspected in children with nasal obstruction, snoring, mouth breathing, recurrent nasal discharge and daytime sleepiness. Early diagnosis and treatment of OME is necessary to prevent significant hearing loss with speech and auditory processing disorders.[11] Hearing assessment in children more than 5 years is usually done by Pure Tone Audiometry (PTA) and in younger children hearing threshold is noted by Visual Response Audiometry (VRA) or Brain Stem Evoked Response Audiometry BERA. The former two are subjective tests while the latter is an objective test. Impedance audiometry, an additional objective and reliable middle ear assessment can be easily performed in children.[12,13] Adenoid hypertrophy is confirmed with nasopharyngoscopy. Haapaniemi *et al.*, in an earlier study, observed a sharp decline in prevalence with increasing age because from the age of 7-9 years adenoid starts to regress and nasopharynx starts to grow.[14] The findings were comparable to what we observed in our study. Younger children have smaller nasopharyngeal airways than older children so a smaller adenoid will cause significant nasal obstruction than the latter. Tympanic membrane in otitis media with effusion shows a dull and retracted tympanic membrane with apparent foreshortening of the handle of malleus and the mobility of the tympanic membrane will be restricted and there are air fluid levels and presence of bubbles seen on otoscopic examination. In our study 43% had dull and retracted tympanic membrane and 22% had fluid with air bubbles on otoscopic examination.

In our study most children had B type (58%), 35% had A type curve on tympanometry. Kindermann *et al.* mentioned that eustachian tube obstruction by adenoid tissue was associated with tympanograms suggestive of abnormal pressure in middle ear.[16] Although tympanometry is generally accepted as a reliable diagnostic test for otitis media with effusion the clinical diagnosis of otitis media has also been shown to compare favourably with the results of tympanometry.[15] In our study 65% had abnormal otoscopic findings out of which 58% had B type curve on tympanometry. In our study 8 out of 26 patients with Grade 2 adenoid hypertrophy and 7 out of 21 patients with Grade 3 hypertrophy had no hearing loss. Similarly, in a study by Osman *et al.*, they have concluded that adenoid size and location were not associated with hearing thresholds in children with OME.[17] Although adenoid tissue has a role in OME etiopathogenesis through the development of effusion, there is no direct relationship with hearing thresholds. Factors such as fluid formed in middle ear, changes in tympanic membrane and changes in middle ear pressure can have an impact in hearing threshold. We have observed that although adenoid tissue plays a role in effusion development, it does not seem to have an effect on hearing thresholds in OME. In addition to size, the location of adenoids and its proximity to the eustachian tube plays a major role in the pathogenesis of OME. There is no concrete evidence for adenoidectomy as a definite treatment for children with OME. In a study by Wang *et al.*, they concluded that the enlargement of the adenoid only partially explains the occurrence of OME [18] Els T *et al.* suggest that adeno-tonsillar pathology may play an aetio-pathological role in the development of OME through the presence of biofilms rather than obstructive adenoid hypertrophy[19] Casselbrant ML *et al.* suggest that adenoidectomy should be reserved for those with nasal indications for adenoidectomy, such as nasal obstruction, recurrent rhinorrhea and/or chronic adenoiditis as it provided no additional benefit to insertion of tympanostomy tubes as an initial procedure for OME.[20]

CONCLUSION

We have concluded that adenoid hypertrophy has significant effect on the development of otitis media with effusion, but size of adenoids has no effect on the severity of hearing loss and tympanometry findings. Hence it is prudent not to follow adenoidectomy as first line of treatment for very young children with OME, unless the child has other symptoms like mouth breathing and snoring. But it is necessary to do a hearing assessment in children with adenoid hypertrophy as hearing loss due to development of OME can be missed leading to problems with speech and language development and poor scholastic performance. The two conditions go hand in hand and diagnosis of one condition should lead to suspicion of the other and prompt treatment should be initiated.

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