

Original Research Article

Unmask the silent hearing loss: a study of audiological profile in children with chronic adenotonsillitis

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ABSTRACT

Background: Chronic adenotonsillitis results in obstruction of eustachian tube (ET) due to edema, by mechanical obstruction and the upper respiratory tract infection disrupts the mucocilliary action of ET which can lead to otitis media with effusion (OME). This when unresolved can result in persistent hearing loss and this might cause subsequent delay in development of language, social behaviour, learning difficulties which will affect the academic performance. Young children as are unable to voice their hearing loss and sometimes due to inattentiveness of parents to child's hearing disorder; this might be neglected. The condition remains masked for a long time and hence need to be unmasked for its appropriate management.

Methods: It is cross sectional study involving cases of chronic adenotonsillitis from November 2016 to May 2018. After enrolling the patients who met the inclusion criteria, their demographic details, examination findings including the findings of x-ray nasopharynx, pure tone audiometry (PTA) and tympanometry were noted for analysis.

Results: Total 100 patients were studied in which history of hearing loss was seen in 23% and parents' suspicions was in 22% of cases whereas hearing loss was demonstrated in 51% of cases using PTA ranging from 16-70 db in hearing level. Analyses of tympanogram revealed 43% to have either type B or type C tympanogram which are suggestive of OME.

Conclusions: Audiological screening for children diagnosed with chronic adenotonsillitis needs to be made mandatory to detect OME, the silent hearing loss as parents as well as children will miss out on it.

Keywords: Chronic adenotonsillitis, OME, Pure tone audiometry, Tympanometry

INTRODUCTION

Adenoid is a lymphoid tissue lying within the mucous membrane of the roof and posterior wall of the nasopharynx which may extend to the fossa of Rosenmuller and to the eustachian tube (ET) orifice as Gerlach's tonsil.¹ Tonsils are pair of aggregated lymphoid tissue which forms a part of Waldeyer's ring along with adenoid, lingual tonsil and aggregates of pharyngeal submucosal lymphoid tissue forming a complete ring circle of lymphoid tissue surrounding the entrance of gastrointestinal and respiratory tracts.²

Adenoid hypertrophy (AH) is one of the common causes for childhood morbidity.³ Its pathological effects include rhinitis, rhino sinusitis, otitis media and otitis media with effusion (OME).¹

ET which maintains the middle ear ventilation is lined by ciliated, pseudo stratified columnar epithelium which is same as that of respiratory tract lining which extend as far as anterior part of middle ear cavity. Upper respiratory tract infection disrupts the mucocilliary action of ET due to edema as well as loss of cilia which can lead to OME. Adenoid, which is acting as reservoir in upper respiratory infections, when chronically infected results in

obstruction of ET due to edema and as well as by its mechanical obstruction.⁴ Even enlarged tonsils can mechanically obstruct the movement of soft palate and hence hinders the opening of ET.⁵

OME is the chronic accumulation of mucus within the middle ear and sometimes the mastoid air cell system. ET dysfunction is one of the aetiologies for OME.⁶ Approximately 50% of OME resolves spontaneously within 2-3 months, but 5% may result in persistent hearing loss for about a year. This might cause subsequent delay in development of language, social behavior, learning difficulties which will affect the academic performance.⁷

Young children as are unable to voice their hearing loss and sometimes due to inattentiveness of parents to child's hearing disorder; this might be neglected. The condition remains masked for a long time and hence need to be unmasked for its appropriate management.

Objectives

The objective of this study was to analyse the audiological profile in children diagnosed with chronic adenotonsillitis.

METHODS

It was a cross sectional study done during the period of November 2016 to May 2018. Study was conducted on patients attending ENT outpatient departments attached to Bangalore Medical College and Research Institute Bangalore, who met the inclusion criteria.

Inclusion criteria

Patients aged between 2-12 years, diagnosed with chronic adenotonsillitis and guardians/parents of patients willing to give written and informed consent were included in the study.

Exclusion criteria

Acute adenotonsillitis, ear discharge, tympanic membrane perforation, cleft palate, congenital ear deformities, history of previous adenoidectomy and history of allergic rhinitis were excluded from the study.

After obtaining clearance and approval from the institutional ethics committee and written informed consent from parents/guardian and informed assent form from the children, patients who fulfil the inclusion criteria were enrolled in the study.

Demographic data, detailed history of complaints suggestive of chronic adenotonsillitis like mouth breathing, difficulty breathing through nose, snoring, throat pain, throat discomfort, any parental suspicion of hearing loss and other relevant histories were recorded.

Later general and ENT examination was carried out. All the findings were recorded in study proforma. For ear examination, ear wax, if any, was carefully removed and later was evaluated by otoscopy. Condition and appearance of tympanic membrane was noted down. Oral cavity and oropharynx were examined. Tonsillar hypertrophy was graded according to Brodsky scale. The term "kissing tonsils" implies that the tonsils meet in the midline, entirely within the oropharynx.

If the patient was suspected to have adenotonsillitis digital X-ray of nasopharynx soft tissue neck was asked. The grading of AH was calculated using A/N ratio. Later patients who were diagnosed to have chronic adenotonsillitis were subjected to pure tone audiometry and tympanometric examination which was carried out by an audiologist. Hearing impairment (HI) was classified as per Clark's classification. In the end the status of hearing, condition of middle ear and presence or absence of OME was documented for further evaluation. All the documented findings were analysed using PSPP software (GNU General Public License Version 3). Necessary figures and tables were used.

RESULTS

A total of 100 patients (200 ears) diagnosed with chronic adenotonsillitis were considered for studying. This study showed 45 (45%) of them were female and majority of them were male constituting 55 (55%) of the total cases (Figure 1).

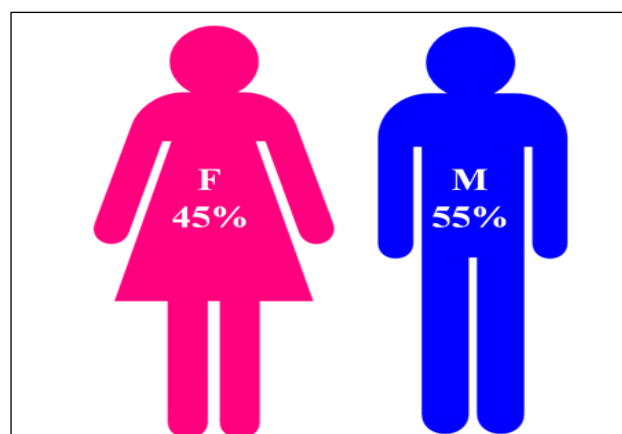


Figure 1: Gender distribution.

When distribution according to age was analysed it showed that maximum number of cases were 8 years old (21%), followed by 6 years old (16%) and least in 4 years old (4%) and none in 2-3 years of age (Figure 2).

In this study the most common presenting symptoms (Figure 3) were throat pain and snoring (55%, 49%). History of hearing loss was noted in 23% of the cases and parents suspicious of having reduced hearing in a child was found to be 22% of the cases.

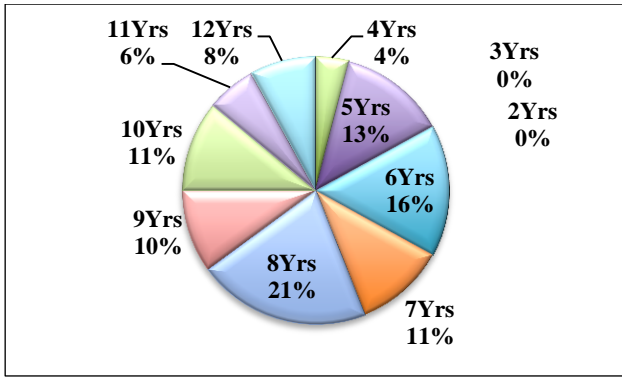


Figure 2: Age distribution.

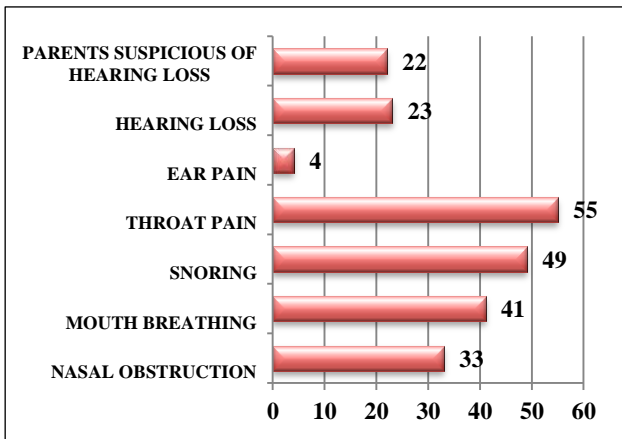


Figure 3: Presenting complaints.

The distribution of cases according to socioeconomic status found majority of them belonging to class II (60%) of modified Prasad’s social classification and 1% in class V.

The total chronic adenotonsillitis cases studied were 100 thus contributing to 200 ears of 200 ears, the tympanic membrane of 133 cases (66.5%) was found to be normal. 30 of the cases (15%) showed retracted tympanic membrane, 13 cases (6.5%) had dull tympanic membrane, 22 cases (11%) had bulging tympanic membrane (Figure 4 A and B) and only 2 cases (1%) was found to have bluish appearance of the tympanic membrane. The right and left ear had similar presentations with respect to appearance of tympanic membrane.

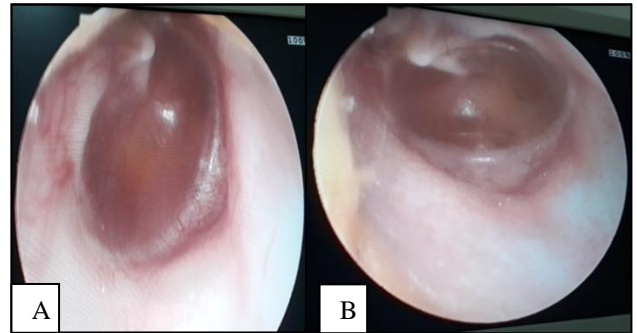


Figure 4 (A and B): Bulging right and left tympanic membrane in a case of bilateral OME.

In the current study, 94 ears (49%) were found to have normal hearing. Minimal hearing loss which ranged from 16-25 dB in hearing level (HL) consisted of 62 ears (32.3%). Mild hearing loss with range of 26-40 dB HL was seen in 25 ears (13%) (Figure 6). Moderate hearing loss ranging from 41-55 dB HL constituted 9 ears (4.7%). Moderately severe hearing loss was noted only in two ears (1%) (Figure 5). 4 cases were not analysed as they could not comprehend with pure tone audiometry (PTA) methodology.

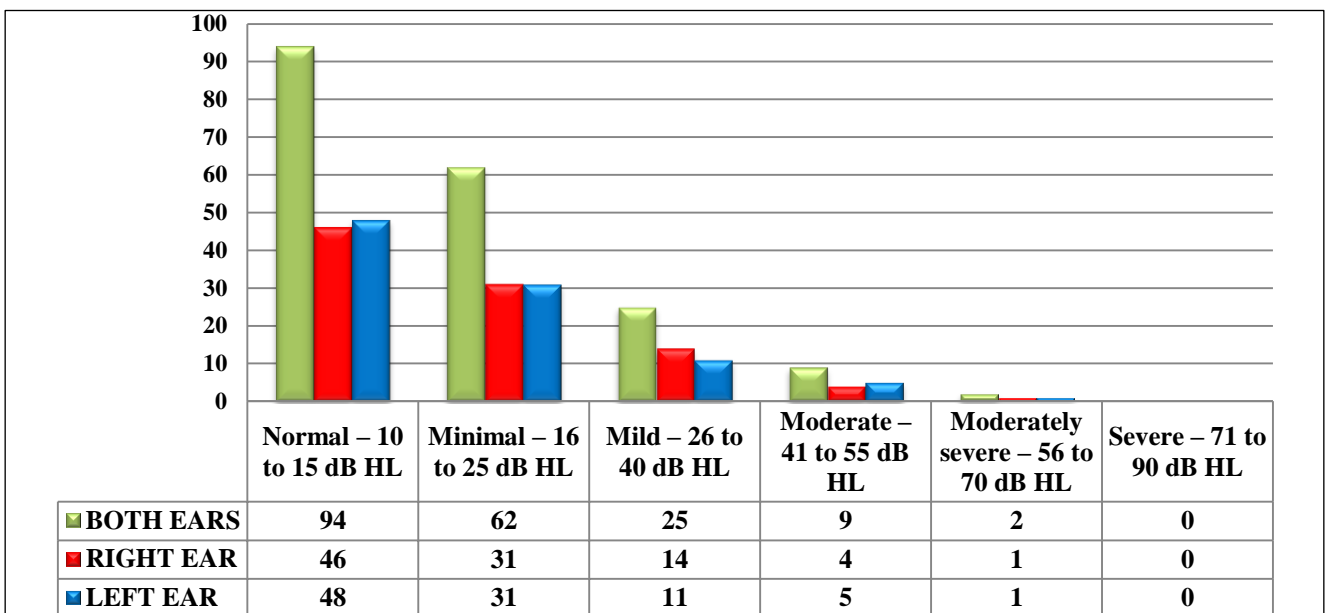


Figure 5: Hearing loss in chronic adenotonsillitis.

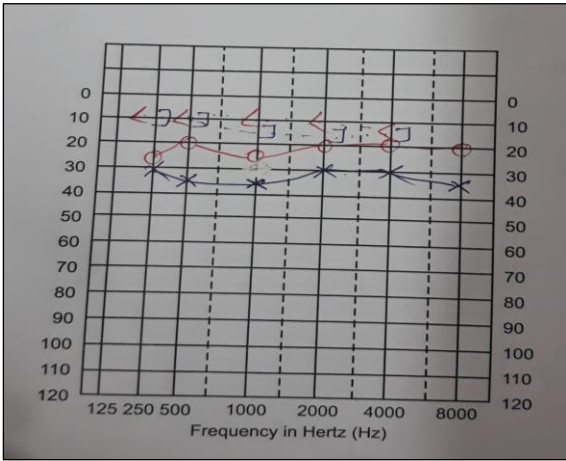


Figure 6: PTA of 8 year old child with chronic adenotonsillitis showing 21.6 dB HL on right and 33.3 dB HL on left ear.

Analyses of tympanogram showed majority of ears were normal with tympanogram curve A constituting 114(57%) whereas 60 (30%) ears showed type B tympanogram (Figure 7) and 26 (13%) ears showed type C (Figure 8) tympanogram which are suggestive of OME. 35 cases had bilateral ear involvement for OME.

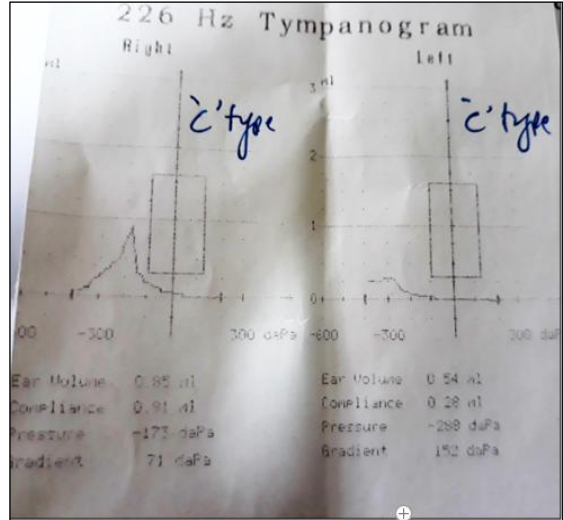


Figure 8: Type C tympanogram.

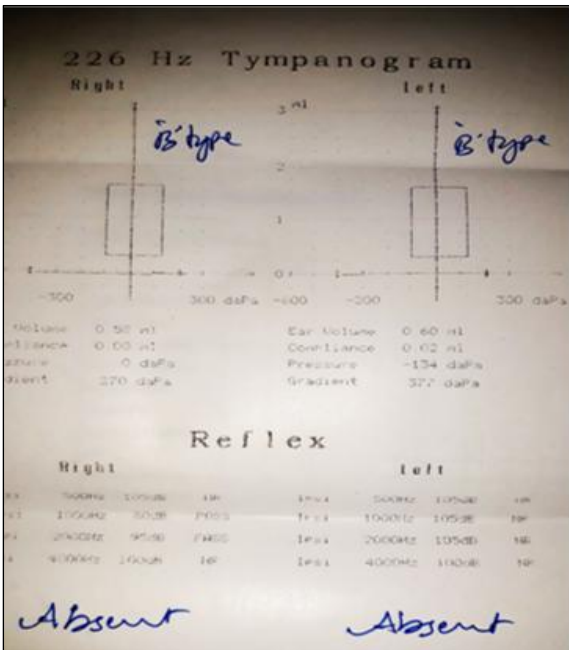


Figure 7: Type B tympanogram.

When different complaints of those who were diagnosed with OME was analysed author could see that, parents suspicious of hearing loss in their child and history of hearing loss was seen only in 37 (43%) cases. Totally 57% of cases of OME had no such complaints (Figure 9). Also, correlation study (Table 1) showed significant positive correlation occurring between chronic adenotonsillar hypertrophy with HI. Both adenoid and tonsillar hypertrophy showed negative correlation with socioeconomic status, i.e., as status increased there was decrease in the size of adenotonsillar hypertrophy. However, this was statistically insignificant. There was no correlation seen between the adenotonsillar hypertrophy and that of history of hearing loss by a child and parents suspicious of hearing loss in a child.

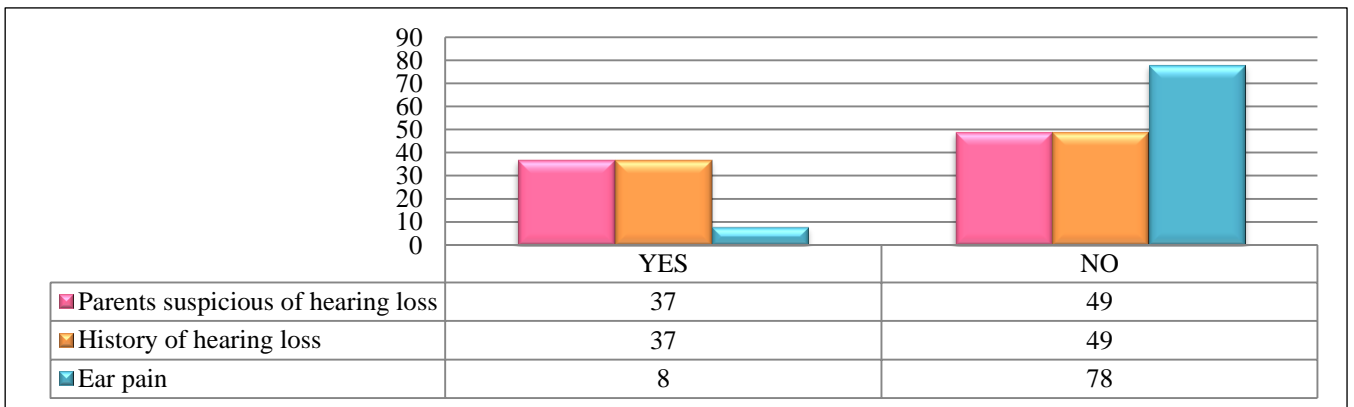


Figure 9: Aural complaints in cases of OME.

Table 1: Co-relation study.

		Adenoid	Tonsil	HI	SES
Adenoid	Pearson correlation	1	0.197**	0.359**	-0.154
	Sig. (2-tailed)		0.005	0.000	0.125
	N	200	200	192	100
Tonsil	Pearson correlation	0.197**	1	0.143*	-0.131
	Sig. (2-tailed)	0.005		0.049	0.194
	N	200	200	192	100

** :Correlation is significant at the 0.01 level (2-tailed); * :Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

Hearing impairment could negatively impact on the development of communication skills if not detected and treated early. Sallavaci et al, conducted a cross sectional survey in order to assess the prevalence of HI among preschool children and factors associated with it. It included 400 preschool children aged 4-6 years old between 2009-2011. They found the total prevalence of HI was 16%. They concluded that we need to be aware that it is serious problem which will have negative effect on development of child and hence needs to be addressed.⁸ Likewise a few studies have been done in order to know the prevalence of OME which is one of major cause of HI.

Sanil et al conducted a prevalence study in a 4 randomly selected school children in order to find the etiopathogenic relation of OME. A total of 1,165 children participated of which 143 of the cases (12.2%) had OME. They concluded that national wide prevalence study for OME is not done and that OME is a common disease that can lead to other hard-to cure health problems. They mentioned positive relation of AH with OME.⁹

Of 200 cases, we could see there were 114 normal ears and rest 86 ears with OME. Thus, the prevalence was 43%. Sharma et al, found incidence of OME to be 33.4% in their study.¹⁰ In this 86 cases, it was found that 6 yrs of age had maximum number of cases i.e., 16% which was also comparable with those in 8 years of age i.e., 15% and it reduced as age increased. Least number of cases was in 4 years old (4%) and none in 2-3 years of age. A study by Ajayan et al also showed maximum number of patients in the age group of 5-10 years.¹¹ This observation was in concurrence with a study of Fujioka et al, which showed that the size of the adenoid though varies from child to child; the adenoids attain their maximum size between 4-8 years of age after which it regresses gradually till the age of 12 years.¹²

Sanli et al mentioned that age is the most important risk factor for OME.⁹ It is a childhood disease and as the age gets older, the incidence rate of the effusion decreases. This is because the ET shifts its anatomical orientation and gradually changes its angle from horizontal to vertical with age and as the child grows the immune

system gets stronger by having met many types of allergens.

Appearance of tympanic membrane in chronic adenotonsillitis and in OME cases

Of 200 ears studied, tympanic membrane in 133 ears (66.5%) appeared normal. In 26 ears (30%) it was retracted, in 21 ears (25%) it was bulging, in 13 cases (15%) it was dull and in 2 ears (2%) it appeared bluish. Sharma, Mehan et al, in their study got 52.65% of ear with normal TM, 41.2% cases were having dull and retracted TM and 4.35% were congested and 1.8% were atrophic.¹³

In this study among 86 cases of OME, dull and retracted (45%) tympanic membrane was seen to be maximum followed by 21% who had bulging TM, only 2% had bluish TM and 24% of TM appeared normal. Even in study by Sharma et al, clinically, 74% ears had dull and retracted TM, 3% had thin and retracted TM and only 2% ears showed the characteristic air bubbles behind the eardrum, whereas the rest 21% were normal on otoscopy.¹⁰

Retracted tympanic membrane was found to be the commonest otoscopic sign (83%) in Khmmas et al, this agrees with, Ahmad et al, study, in which it was (91.7%) and by Orji and Mgbor study which showed that it was the most specific otologic finding in detection of OME.¹⁴⁻¹⁶ While Syed et al study found that, the most common sign was dull eardrum.¹⁷ The varied findings in otoscopy may be due to different pathological stages of OME. Also, according to agency for health care research and quality, otoscopic appearance is reliable in two-third cases of OME.

Chronic adenotonsillar hypertrophy and its relationship with OME

Sharma et al mentioned on radiological examination 34.3% children had adenoid grade I, 35.8% had grade II and 36.8% had grade III AH.¹⁰ 9.3% cases had grade IV adenoids and they suggested that adenoids are a risk factor for OME not just owing to their size, but also due to the recurrent infection that leads to collection of fluid behind the ear.

In another study by Sharma et al, had shown Grades II, III, and IV hypertrophy of adenoids seen in 22%, 54.67%, and 23.33% patients, respectively in their study.¹³ Thus, 78% patients had either Grade III or Grade IV hypertrophy that is, more than 50% obstruction of the nasopharyngeal airway. This is similar to this study showing grade III (40%) of AH followed by grade IV (33%), grade II constituted 25% of case, grade I (2%) was the least and thus 73% had either grade III or Grade IV.

On the other hand, Sanli et al stated tonsillar hypertrophy can lead to recurrent tonsillitis and result in OME. Among the 100 cases studied in present study, majority of them had grade 3 tonsillar hypertrophy (48%) followed by grade 2 tonsillar hypertrophy (46%) and grade 4 tonsillar hypertrophy was seen in only 6 cases (6%).⁹ Here we can see grade 2 and 3 constitute around 94% which is comparable with Ajayan et al; where they got tonsillar hypertrophy of 2nd and 3rd grades to be most common grades together constituting around 90% of cases. They have stated that the effect of both obstruction and infection from tonsil and adenoid are seen to cause major ill effect nose and paranasal sinus, ET and middle ear cleft.¹¹

Hearing assessment in chronic adenotonsillitis

This Co-relation study showed significant positive correlation occurring between chronic adenotonsillar hypertrophy with HI. There was no correlation seen between the adenotonsillar hypertrophy and that of history of hearing loss by a child and parents suspicious of hearing loss in a child.

This study revealed that history of hearing loss was given by only 23% and parents suspicious for the same was seen in only 22% of the study population. Whereas pure tone audiometry revealed only 49% with normal hearing range. Rest 51% was having different degree of hearing loss ranging from minimum hearing loss to severe. The same scenario was witnessed in study by Sharma et al, where only 16.2% cases actually complained of hearing loss. This highlights the importance of regular screening and early intervention of silent hearing loss.¹⁰

In this study when different complaints of those who were diagnosed with OME was analyzed author could see that, parents suspicious of hearing loss in their child and history of hearing loss was seen only in 37 (43%) cases. Totally 57% of cases of OME had no such complaints.

In another study by Sharma et al, only 32% complained of hearing loss whereas 69.75% patients had PTA AC threshold >20 dB.¹⁰ Lo et al, stated that no significant association was found between parent suspected hearing loss and PTA findings ($p=0.69$) in a case control study, which used data from a school screening program in China. This proves that OME is a cause of silent deafness and needs a high degree of suspicion for its diagnosis.

Missing out on diagnosing HI in children might negatively affect the future development of speech, language and communications skills as well as their academic performance.⁸ Furthermore, HI can put children at higher risk of physical, social and emotional abuse and later during adulthood it can be associated with feeling embarrassed, loneliness, social isolation, abuse, depression, uneasy relationships, low career opportunities and low earnings.

Early detection of HI [in preschool children] and subsequent corrective measures can improve school attainment and communication skills.⁸

A study among 1528 preschool children aged 2-7 years suggested that children with mild hearing loss (20-40 dB) had significantly more phonologic, grammar and vocabulary problems compared to normal hearing children (<20 dB), suggesting that even mild hearing loss could be detrimental.¹⁸ Therefore, the detection and treatment of even mild HI is important in order to prevent the adverse effects associated with it. To this goal, it is suggested that the primary target population for preschool screening is children aged 4-7 years old.¹⁹

Tympanometry in chronic adenotonsillitis

Analyses of tympanogram in this study showed majority of ears were normal with Tympanogram curve A constituting 114 (57%) whereas 60 (30%) ears showed type B tympanogram and 26 (13%) ears showed type C tympanogram which are suggestive of OME. 35 cases had bilateral ear involvement for OME. Kocycigit et al, obtained type A tympanogram in 448 patients without adenoid vegetation (84.4%), type B in 19 (3.6%), and Type C in 64 (12%) patients.²⁰ Sharma et al, conducted impedance audiometry on their patients and 34.5%, 50.17%, 15.33% ears showed type A, type B, and type C tympanograms, respectively.¹⁰

Sanli et al studied overall 1,165 cases, in which 143 cases (12.2%) had clinical OME. 1,037 cases (89.01%) had type A tympanogram and 128 cases (10.9) had type B tympanogram. It is stated that a type B curve in tympanometry has an over 80% sensitivity of detection for OME.⁹

Günel et al found type B tympanograms provided a sensitivity of 92.3% and a specificity of 91.9%. So, they suggested that tympanometry can make a more accurate diagnosis of pediatric OME in AH children with or without parental suspicion of HI.²¹ Therefore, tympanometry should be used as a routine examination of the middle ear in children with AH. In Nwosu et al, showed higher proportion of type B tympanogram than type C. So, they associated that middle ear effusion occurs more than ET dysfunction in patient with AH, which is more associated with severe HI.⁴

Rosenfeld et al, addressed OME as an “occupational hazard of early childhood” because about 90% of children have OME before school age 5 and they develop, on average, 4 episodes of OME every year.⁷ The indirect costs are likely much higher since OME is largely asymptomatic and many episodes are therefore undetected, including those episodes in children with hearing difficulties or school performance issues.

Babu et al, stated the prevalence of OME has increased in last 50 years, due to widespread inadequate use of antibiotics for the treatment of acute otitis media. The hearing loss may be latent or overt with the child rarely complaining of it.²²

Guenel et al, mentioned Signs and symptoms of OME are usually occult.²¹ Some children with AH have OME in spite of having no complaint of hearing loss. Sometimes parents are not aware of their children’s symptoms of hearing loss. This was found true in this study. Untreated OME may result in serious consequences in the form of poor speech and intellectual development and permanent anatomical distortions within the middle ear cavity. Therefore, correct and early diagnosis and appropriate treatment of OME in children is imperative.

CONCLUSION

Hence audiological screening for children diagnosed with chronic adenotonsillitis needs to be made mandatory to detect the silent hearing loss caused by OME. Majority of them belongs to minimal HI which is asymptomatic. Parents as well as children need to be made aware of this problem so as to make early detection possible and to institute correction of this reversible hearing loss.

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REFERENCES

1. Robb PJ. The adenoid and adenoidectomy. In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, et al, eds. *Scott-Brown's Otorhinolaryngology: Head and Neck Surgery*. 7th ed. London: Hodder Arnold; 2008: 1094-1101.
2. McKerrow WS. Diseases of the tonsil. In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, et al, eds. *Scott-Brown's Otorhinolaryngology: Head and Neck Surgery*. 7th ed. London: Hodder Arnold; 2008: 1219-1228.
3. Ren DD, Wang WQ. Assessment of middle ear effusion and audiological characteristics in young children with adenoid hypertrophy. *Chinese Med J*. 2012;125(7):1276-81.
4. Nwosu C, UjuIbekwe M, Obukowho Onotai L. Tympanometric Findings among children with adenoid hypertrophy in Port Harcourt, Nigeria. *Int J Otorhi*. 2016:1276543.
5. Vijayan A, Ramakrishnan VR, Manjuran TJ. Relationship between adenotonsillar hypertrophy and otitis media with effusion. *Int J Cont Med Res*. 2018;5(2):B1-5.
6. Browning G. Otitis media with effusion. In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, et al, eds. *Scott-Brown's Otorhinolaryngology: Head and Neck Surgery*. 7th ed. London: Hodder Arnold; 2008: 877-911.
7. Rosenfeld RM, Shin JJ, Schwartz SR, Coggins R, Gagnon L, Hackell JM, et al. *Clinical Practice Guideline Otitis Media with Effusion Executive Summary (Update)*. *Otolaryngol Head Neck Surg*. 2016;154(2):201-14.
8. Sallavaci S. Prevalence and factors associated with hearing impairment in preschool children in Albania. *Arch Med*. 2016;8:4.
9. Sanli A, Tasdemir O, Eken M, Celebi O, Yilmaz SH. Prevalence of otitis media with effusion among primary school age-children and etiopathogenic examination. *Ind J Otolaryngol Head Neck Surg*. 2014;66(1):95-8.
10. Sharma K, Pannu MS, Arora A, Sharma V. Preventive audiology: screening for hearing impairment in children having recurrent URTI. *Ind J Otolaryngol Head Neck Surg*. 2016;68(2):163-6.
11. Ajayan PV, Raj DML, Jacob AM. A study on the effect of adenoidectomy with tonsillectomy in otitis media with effusion in children. *Int J Res Med Sci*. 2017;5:1796-801.
12. Fujioka M, Young LW, Girdany BR. Radiographic evaluation of adenoidal size in children: adenoidal-nasopharyngeal ratio. *Am J Roentgenol*. 1979;133(3):401-4.
13. Sharma K, Mehan R, Arora A. Clinicoaudiological and operative evaluation of otitis media with effusion. *Indian J Otol*. 2015;21:1748.
14. Khmmas AH, Dawood MR, Kareem A, Hammadi YA. Diagnostic accuracy of otitis media with effusion in children. *Mustansiriyah Med J*. 2016;15(1):1-6.
15. Al-Juboori AN, Al-Aqeedee AA, Saeed HD. Otitis Media with Effusion in Children: A Follow up Study in West Baghdad, Iraq. *J Commun Dis Deaf Studies Hearing Aids* 2014;2(4):2375-4427.
16. Orji FT, Mgbor NC. Otoscopy compared with tympanometry: an evaluation of the accuracy of simple otoscopy. *Niger J Med*. 2007;16(1):57-60.
17. Syed HI, Arif HB, Abu Yusuf F. Study on otitis media with effusion. *Bangladesh J Otolrhinolaryngol*. 2009;15:50-4.
18. Schönweiler R, Ptok M, Radu HJ. A cross-sectional study of speech- and language-abilities of children with normal hearing, mild fluctuating conductive hearing loss, or moderate to profound sensorineural hearing loss. *Int J Pediatr Otorhinolaryngol*. 1998;44:251-8.

19. Skarznski H, Piotrowska A. Screening for pre-school and school-age hearing problems: European Consensus Statement. *Int J Pediatr Otorhinolaryngol.* 2012;76:120-1.
20. Kocyigit M, Ortekin SG, Cakabay T, Ozkaya G, Bezgin SU, Adali MK. Frequency of serous otitis media in children without otolaryngological symptoms. *Int Arch Otorhinolaryngol.* 2016.
21. Günel C, Ermişler B, Başak HS. The effect of adenoid hypertrophy on tympanometric findings in children without hearing loss. *Kulak Burun Bogazİhtis Derg.* 2013;24(6):334-8.
22. Babu S, Prabakaran J, Radhakrishnan S. Prevalence and management of otitis media with effusion amongst the school going children of a rural area in Puducherry. *Bengal J Otolaryngol Head Neck Surg.* 2016;24(1):21-8.

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