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ORIGINAL RESEARCH

Study of audiological profile in patients with chronic adenotonsillitis

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Abstract

Background: Adenoid hypertrophy is one of the common causes for childhood morbidity.[1] Its pathological effects include rhinitis, rhino sinusitis, otitis media and Otitis Media with Effusion (OME).[1]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.[2]Looking into the ear of children at the earliest is beneficial and for this purpose audiological assessment is helpful.

Method: The sample consisted of 70 children who presented with symptoms of chronic adenotonsillitis . This prospective study was conducted from November 2019 to may 2021 in Department of ENT at Vijayanagara Institute of Medical Sciences Ballari . The age group of the study sample is between 5-16years.

Results: There was statistically significant positive correlation with chronic adenotonsillar hypertrophy grading and hearing impairment. 82.2% had either grade III or Grade IV Adenoid Hypertrophy and tympanometry type B & C curve had maximum of grade III or IV AH.

Conclusion: Hearing loss ranging from 16-55 dB HL is noted in cases of chronic adenotonsillitis in which majority of them belongs to minimal hearing impairment which will be asymptomatic and if it is prolonged can cause significant hearing loss and might result in subsequent delay of speech, language, communications skills and poor academic performance. Hence audiological screening for children diagnosed with chronic adenotonsillitis needs to be made mandatory to detect this silent hearing loss.

Keywords: ADENOID HYPERTROPHY, OTITIS MEDIA WITH EFFUSION, TYMPANOMETRY, PURE TONE AUDIOGRAM.

Introduction

The Adenoids and tonsils are lymphoid tissues in nasopharynx, which are a part of Waldeyer's ring of lymphoid tissue. They become clinically significant when they undergo hyperplasia. In the past it was usual to therapeutically remove enlarged adenoids & tonsils. But now it is recognized that lymphoid hyperplasia is not itself an indication for adenotonsillectomy .

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 Rosenmu¨ller and to the eustachian tube orifice as Gerlach's tonsil[1]. The nasopharyngeal tonsil was observed to become evident by six months to one year of life, increases rapidly in size during the first 6 to 8 years of life & generally atrophies by adolescence.[2] 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.[3]

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Adenoid hypertrophy 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]
Eustachian tube (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 (URTI) disrupts the mucocilliary action of ET due to oedema 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[4-5] . Even enlarged tonsils can mechanically obstruct the movement of soft palate and hence hinders the opening of ET.[6]
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.[3]
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 behaviour, 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. Looking into the ear of children at the earliest is beneficial and for this purpose audiological assessment is helpful.

Clinical evaluation
As OME is highly prevalent in the childhood population and is frequently asymptomatic, it is suggested for universal screening of children for early diagnosis and prompt treatment of the same.
History: They may present with recurrent upper respiratory infections, ear fullness, reduced hearing, mouth breathing and snoring. Parents may even notice reduced response from child when spoken to them.
The ideal strategy for the diagnosis of OME in children should be based on combination of otoscopy, tympanometry and audiometry.
Otoscopy: The otoscopic appearances of OME are extremely variable and take experience to reliably detect. The appearance are mainly different combinations of retraction of the pars tensa and variations in its colours as yellow, blue or it might be clear. Fluid levels or air bubbles are relatively uncommon.
Audiometry: This is used to measure the hearing threshold. Conventional air and bone-conduction testing is the preferred. It is possible to obtain the threshold in majority of children who are aged over 3.5 years of age on the first occasion. Even if the child's concentration is poor, the results on average are only 5 dB poorer and can still be used to guide management. The presence of an air–bone gap of at least 10 dB is a poor predictor of concurrent OME ideal diagnostic strategy for OME
Tympanometry: One of the reliable methods to detect OME since 1970 is Tympanometry with impedance. Its role as a confirmatory test has also been assessed in secondary care using otoscopy, pure-tone audiometry or surgical findings as the reference standard.
Management: Management can be divided into medical and surgical management.
Medical management includes the use of antibiotics and steroid intranasal sprays. Using antimicrobial therapy is logical as OME is known to contain viable, pathogenic bacteria.
If OME persists in spite of above two measures for more than 90 days, then surgical interventional is required. This might be adenoidectomy, grommet insertion, myringotomy or sometimes even tonsillectomy to remove the foci of infection.
Methodology

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

The sample consisted of 70 children who presented with symptoms of chronic adenotonsillitis. This prospective study was conducted from November 2019 to may 2021 in Department of ENT at Vijayanagara Institute of Medical Sciences Ballari . The age group of the study sample is between 5-16years.

Inclusion criteria: All children from 5-16 years with bilateral nasal obstruction.

Exclusion criteria: Septal deviation, allergic rhinitis, nasal injury and congenital nasal deformities.

Name, age and sex were noted in all the cases. A detailed clinical history was taken regarding presenting complaints. General, ENT and systemic examination were done in all the cases according to predesigned proforma. Study sample was divided into 3 subgroups 5-7, 8-10, 11-13 & 14-16years.

Clinical assessment: 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. Condition and appearance of tympanic membrane was noted down. Oral cavity and oropharynx was examined. Tonsillar hypertrophy was graded according to Brodsky scale.

Table 1: Brodsky scale for tonsillar hypertrophy

SCALE 0	The tonsils are entirely within the tonsillar fossa,
SCALE 1+	The tonsils are located just outside the fossa and occupy less than 25% of the total width of the oropharynx,
SCALE 2+	Tonsils occupy 26% to 50% of the oropharyngeal width
SCALE 3+	Tonsils are 51% to 75%
SCALE 4+	Tonsils occupy more than 75% of the oropharyngeal width.

Radiological examination

Subjects were evaluated with standard lateral cephalometric radiographs. These radiographs were taken with the childs head immobilized in a wall- mounted The head was fixed so that the median plane was parallel to the film.

By using the reference points and lines on lateral radiographs of nasopharynx, Presence or absence of adenoid hypertrophy was assessesd

In all the patients digital x-ray of nasopharynx soft tissue neck was taken. The grading of AH was done using A/N ratio. For calculation of AN ratio (Figure 20) a tangential line is drawn to the basiocciput and labelled as ‘B’. a perpendicular line is drawn to line ‘B’ at the point of maximum tissue of adenoid and labelled as ‘A’. The posterior border of the hard palate and the antero-inferior aspect of the sphenobasiccipitalsynchondrosis represent nasopharyngeal measurement. In below image, Line B is tangential to the basiocciput.

The adenoidal measurement 'A' is obtained by drawing a perpendicular line to B at the point of maximal adenoidal tissue. The nasopharyngeal measurement 'N' is made between the posterior border of the hard palate and the antero-inferior aspect 'S' of the spheno-basiccipitalsynchondrosis (black arrowhead). When the synchondrosis is not visible, point 'S' is determined as the point on the anterior edge of the basiocciput which is closest to the intersection of the lines A and B.

Table 2: Grades of AH based on A/N ratio.

ADENOID SIZE GRADING	A/N ratio

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

GRADE I	<25% of nasopharyngeal airway
GRADE II	25 - 59% of nasopharyngeal airway
GRADE III	50-74% of nasopharyngeal airway
GRADE IV	75 - 100% of nasopharyngeal airway

Audiological assessment

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

Table 3: Clark's classification of hearing impairment[54]

Classification	Hearing Impairment
Normal	10 to 15 dB HL
Minimal	16 to 25 dB HL
Mild	26 to 40 dB HL
Moderate	41 to 55 dB HL
Moderately severe	56 to 70 dB HL
Severe	71 to 90 dB HL
Profound	more than 91dB

In the end the status of hearing, condition of middle ear and presence or absence of OME was documented for further evaluation.

Statistical analysis

All the documented findings were analysed using SPSS 28 software . Necessary graphs and tables were used.

A P value of <0.05 was considered statistically significant.

Sample size estimation

In study conducted by Nwosu C et al[5],136 ears were studied and the incidence of OME was 55.9%.

Using the formula N=4pq/d2

p= prevalence

q= 100-p

d= error allowed (we have taken 15% error)

N=140 (70 cases)

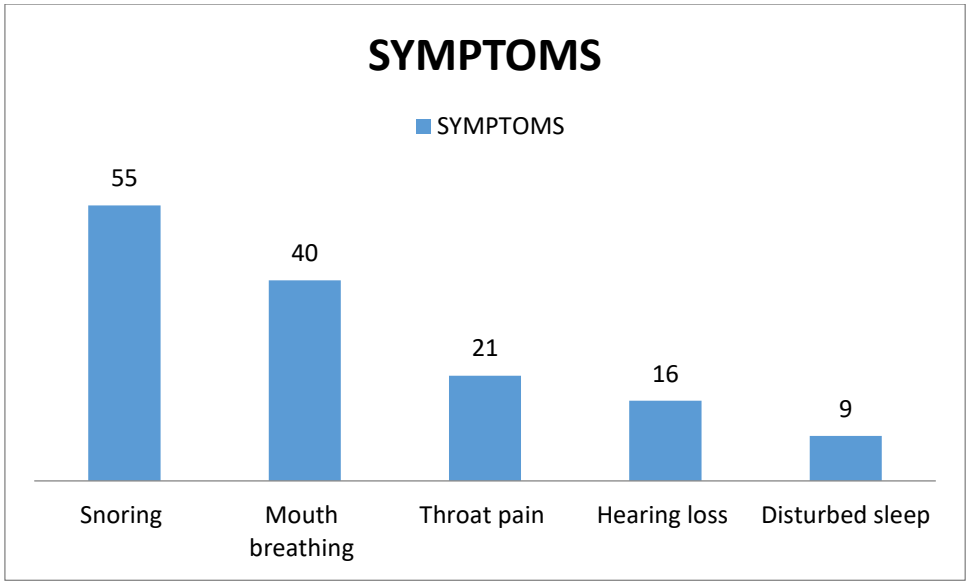
Results

A total of 70 patients (140 ears) diagnosed with chronic adenotonsillitis were considered for studying. In our study 45 cases were males (64%)25 cases were females (36%)

Table 4: Presenting Complaints

Symptom	Number of cases	Percentage %
Snoring	55	78.6
Mouth breathing	40	57.1
Throat pain	21	30%
Hearing loss	16	22.9
Disturbed sleep	9	12.9

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023



Graph 1: Presenting complaints

Appearance of tympanic membrane

The total chronic adenotonsilltits cases studied were 70 thus contributing to 140 ears

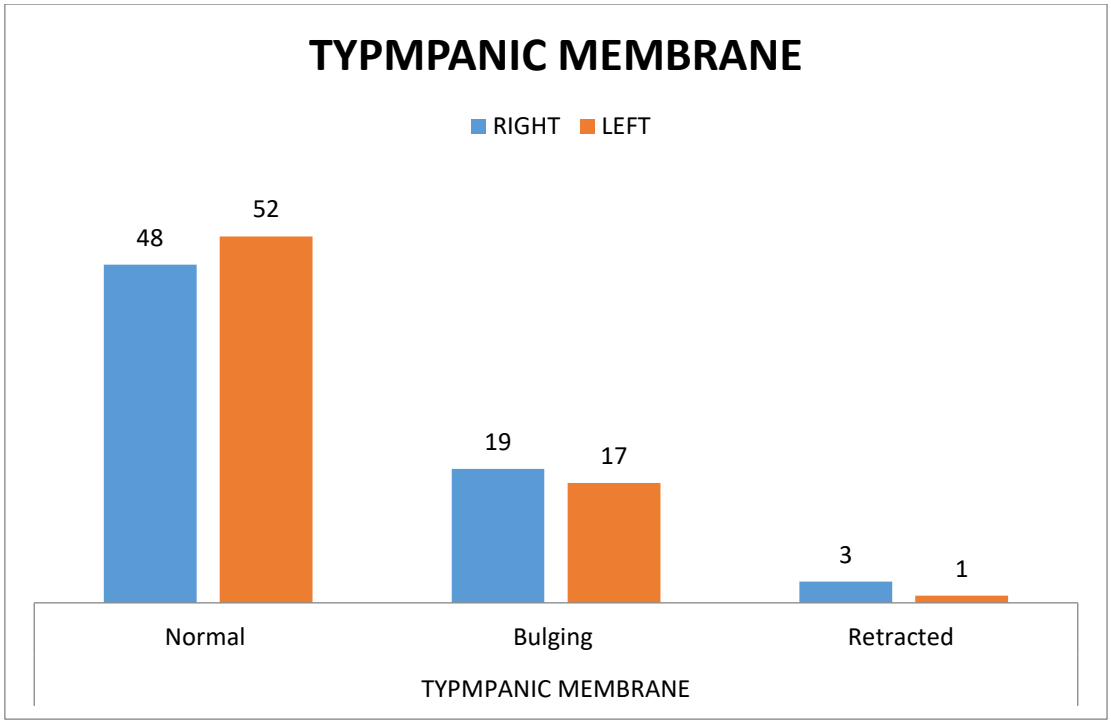
Of 140 ears, the tympanic membrane of 100 cases (71.4%) was found to be normal out of which 48 ears were on the right side and 52 ears on the left side . 36 cases(25.7%)had bulging of tympanic membrane out of which 19 were on right side 17 ears were on the left side. 4 ears were retracted out of which 3 ears were on the right side (4.3%) and one ear was on the left side. The right and left ear had similar presentations with respect to appearance of tympanic membrane.

Table 5: Appearance of tympanic membrane in cases of chronic adenotonsillitis.

Appearance Of Tympanic Membrane	Number Of Ears			
	R	L	Total	%
Normal	48	52	100	71.4%
Bulging	19	17	36	25.7%
Retracted	3	1	4	4.3%

Figure 1 (A) and 6.1(B) Bulging right and left tympanic membrane in a case of bilateral OME.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

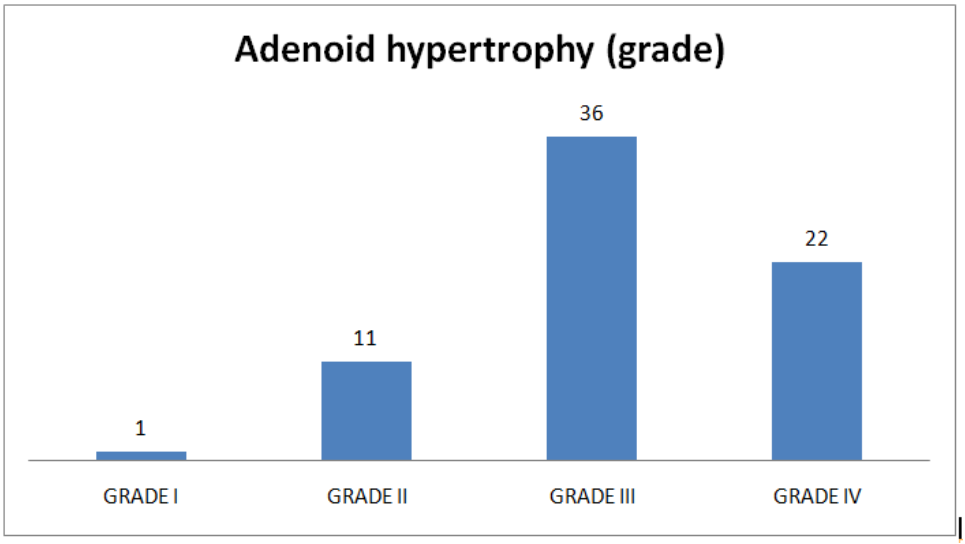


Graph 2: Appearance of tympanic membrane in chronic adenotonsillitis

Among the 70 cases studied, grade 3 tonsillar hypertrophy was seen in 37 cases (52.85%) grade 2 tonsilar hypertrophy was seen in 27 cases (38.5%) grade 4 was seen in 5 patients (7.1%) grade 1 was seen in 1 patient (1.4%) .

Table 6: Adenoid hypertrophy in cases of chronic adenotonsillitis

Adenoid hypertrophy (grade)	No of cases	Percentage %
I	1	1.4
II	11	15.7
III	36	51.4
IV	22	31.4
Total	70	100



Graph 3: Adenoid hypertrophy in cases of chronic adenotonsillitis.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

In the current study, hearing was normal in 64 ears (45.7%) out of which 28 ears on the right side 36 ears on the left side, minimal hearing loss was seen in 42 ears (30%) of which 23 ears on right side and 19 years on the left side , mild hearing loss was seen in 23(16.4%) of which 12 on the right side and 11 on left side, moderate hearing loss was seen in 11 ears(8%) of which 7 on right side 4 on left side.

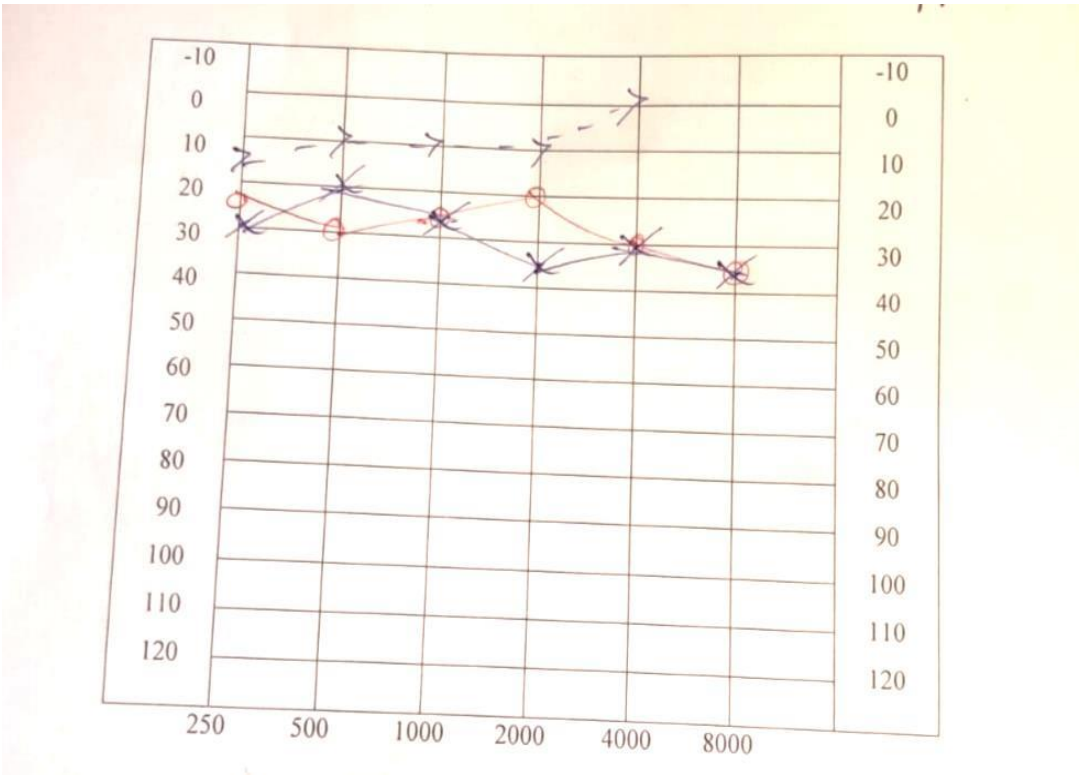
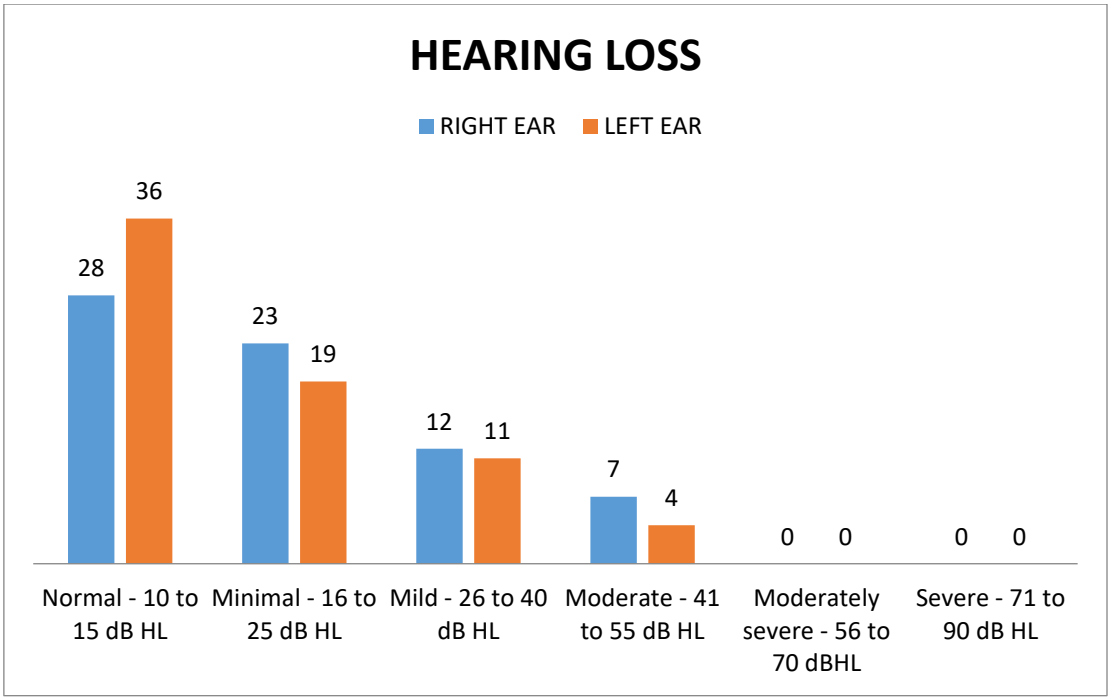


Figure 2: PTA of 10 yr old child showing 25 db HL on right and 26.6 db HL on left ear.

Table 7: Hearing loss in chronic adenotonsillitis.

HEARING LOSS	RIGHT EAR	%	LEFT EAR	%	BOTH	%
Normal – 10 to 15 dB HL	28	40.0	36	51.4	64	45.7
Minimal – 16 to 25 dB HL	23	32.9	19	27.1	42	30
Mild – 26 to 40 dB HL	12	17.1	11	15.7	23	16.4
Moderate – 41 to 55 dB HL	7	10.0	4	5.7	11	7.9
Moderately severe – 56 to 70 dBHL	0	0	0	0	0	0
Severe – 71 to 90 dB HL	0	0	0	0	0	0
TOTAL	70	100	70	100	140	100

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

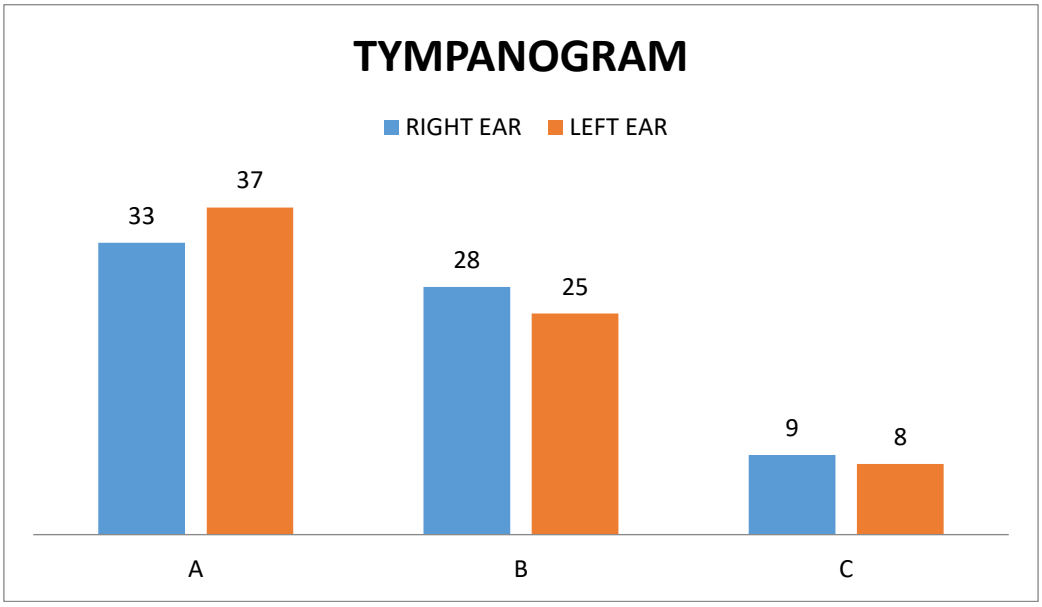


Graph 4: Hearing loss in chronic adenotonsillitis.

Analysis of tympanogram showed type A curve in 70 ears(50%) of which 33 ears on the right side 37 ears on the left side, type B curve was seen in 53 ears (37.8%) of which 28 ears on the right side and 25 ears on the left side , type C curve was seen in 17 ears (12.5%)of which 9 ears on the right side 8 ears on the left side. .

Table 8: Tympanometry in chronic adenotonsillitis.

Tympanogram	Right Ear	%	Left Ear	%	Both	%
A	33	47.1	37	52.9	70	50
B	28	40.0	25	35.7	53	37.85
C	9	12.9	8	11.4	17	12.15
TOTAL	70	100	70	100	140	100



Graph 5: Tympanometry in chronic adenotonsillitis.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

When tympanometric findings were analysed with respect to different grading of adenoid and tonsillar hypertrophy, it was found that Type A had maximum numbers in AH grade III AND II followed by grade IV and least in grade I. Type B showed equal numbers in Grade III and Grade IV. Type C had maximum and equal number of cases in Grade III and Grade IV. (Table 6.11). With respect to tonsillar hypertrophy all had maximum number of cases in grade 2 and 3.

Table 9: Tonsillar hypertrophy in different types of tympanometry.

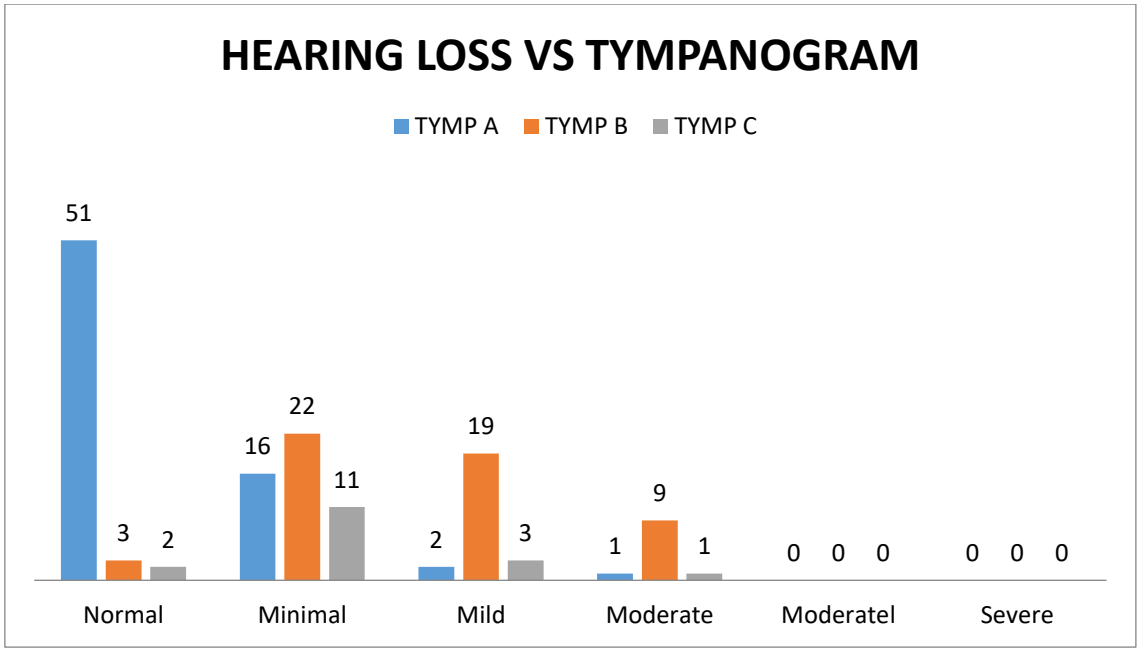
Chi square test							
			Tonsilar hypertrophy				
			1	**2**	**3**	**4**	
type	A	Count	1	32	36	1	0.050
		% within tonsilar	50.0%	59.3%	48.6%	10.0%	
	B	Count	1	18	29	5	
		% within tonsilar	50.0%	33.3%	39.2%	50.0%	
	C	Count	0	4	9	4	
		% within tonsilar	0.0%	7.4%	12.2%	40.0%	
Total		Count	2	54	74	10	
		% within tonsilar	100.0%	100.0%	100.0%	100.0%	

TABLE.10 Hearing loss in different types of tympanometry

	Normal 10 to 15 dB HL	**Minimal – 16 to 25 dB HL**	**Mild – 26 to 40 dB HL**	**Moderate – 41 to 55 dB HL**	**Moderately severe 56 to 70 dB HL**	**Severe – 71 to 90 dB HL**	**p**
TYMP A	51	16	2	1	0	0	<0.001
TYMP B	3	22	19	9	0	0	
TYMP C	2	11	3	1	0	0	

On analyzing degree of hearing loss in different tympanometry curves it was seen that maximus number of type A curve showed normal hearing level. Maximum number of type B curve showed mild hearing loss and maximum number of type C curve showed minimal hearing loss and the difference was statistically significant.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023



GRAPH 6: Hearing loss in different types of tympanometry

Also correlation study showed significant positive correlation occurring between chronic adenotonsillar hypertrophy with hearing impairment.

Table 11: Co-relation study

Spearman's Correlation			
			Tonsilar hyper tropy
Adenoid hyper tropy grade	Tonsilar hypertropy	r	-0.083
		p	0.330
hearing loss	Tonsilar hypertropy	r	**0.174***
		p	**0.040**
hearing loss	Adenoid hypertropy grade	r	-0.037
		p	0.668

Discussion

This is a prospective study conducted on 70 children from age 5-16 years , presenting to Department of ENT, Vijayanagara Institute of Medical Sciences, Ballari, for a period from November 2019 to May 2021.

Demographic data

Study group was divided into 4 groups that is; 5-7 years, 8-10 years , 11-13 years and 14-16years.

In current study male cases were 45(64%) female case 25(36%).

Appearance of tympanic membrane in chronic adenotonsillitis and in OME cases

In our study, out of 140 ears, the tympanic membrane of 100 ears (71.4%) was found to be normal out of which 48 ears were on the right side and 52 ears on the left side . 36 ears(25.7%)had bulging of tympanic membrane out of which 19 were on right side 17 ears were on the left side. 4 ears were retracted out of which 3 ears were on the right side (4.3%) and one ear was on the left side. The right and left ear had similar presentations with respect to appearance of tympanic membrane.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Retracted tympanic membrane was found to be the commonest otoscopic sign (83%) in Khmmas AH et al[8] . This agrees with, Ahmad et al [9], study, in which it was (91.7%). Study conducted by Orji FT and Mgbor NC showed that retracted tympanic membrane was the most specific otologic finding in detection of OME[10]. While Syed et al, study found that, the most common sign was dull eardrum[11]. 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.

Radiological examination, gradings of chronic adenoid
Hypertrophy and its relationship with OME

Sharma K et al[12] has mentioned on radiological examination that 34.3 % children had adenoid grade I , 35.8 % had grade II and 36.8 % had grade III AH. 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.

Chronic tonsillar hypertrophy and OME

On the other hand Sanli A et al [13]; stated tonsillar hypertrophy can lead to recurrent tonsillitis and result in OME.

Among the 70 cases studied in present study, majority of them had grade 3 tonsillar hypertrophy (52.8%) followed by grade 2 tonsillar hypertrophy (38.5%) and grade 4 tonsillar hypertrophy was seen in only 5 cases (7.1%). Here we can see grade 2 & 3 constitute around 91% which is comparable with Ajayan PV et al [14]; where they got Tonsillar hypertrophy of 2nd and 3rd grades to be most common grades together constituting around 90% of cases. They 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.

Hearing assessment in chronic adenotonsillitis

Our Co-relation study showed significant positive co-relation occurring between chronic adenotonsillar hypertrophy with hearing impairment. There was no correlation seen between the adenotonsillar hypertrophy and that of history of hearing loss by a child

Our study revealed that history of hearing loss was given by only 22.9% of the study population. Where as Pure tone audiometry revealed only 45.7% with normal hearing range. Rest 54.3% 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 [12] where only 16.2 % cases actually complained of hearing loss. This highlights the importance of regular screening and early intervention of silent hearing loss.

In another study by Sharma K et al[12]; only 32% complained of hearing loss whereas 69.75% patients had PTA AC threshold >20 dB. Lo et al[15] 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.

Tympanometry in chronic adenotonsillitis

Analyses of tympanogram in our study showed majority of ears were normal with Tympanogram curve A constituting 70 (50%) whereas 53 (37.8%) ears showed type B tympanogram and 17 (12.2%) ears showed type C tympanogram which are suggestive of Otitis media with effusion

OME in chronic adenotonsillitis

Of 140 ears, we could see there were 70 normal ears and rest 70 ears with OME.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 12, 2023

Thus the prevalence was 50%. Sharma K et al[12] found incidence of OME to be 33.4 % in their study. In our 70 cases, it was found that maximum number of cases were seen in the age group of 5-7 years

SanliA et al[13] mentioned that age is the most important risk factor for OME. 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.

Conclusion

There is a significant positive co-relation occurring between chronic adenotonsillar hypertrophy with hearing impairment. Higher the grades of chronic adenoid hypertrophy, greater are the chance of otitis media with effusion.

- Hearing loss ranging from 16-55 dB HL is noted in cases of chronic adenotonsillitis in which majority of them belongs to minimal hearing impairment which will be asymptomatic and if it is prolonged can cause significant hearing loss and might result in subsequent delay of speech, language, communications skills and poor academic performance.
- Henceaudiological screening for children diagnosed with chronic adenotonsillitis needs to be made mandatory to detect this silent hearing loss.

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