Relationship between Adenotonsillar Hypertrophy and Otitis Media with Effusion

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ABSTRACT

Introduction: Otitis media with effusion is one of the commonest chronic otological conditions of childhood. It results from alteration of the mucociliary system within the middle ear cleft. It is especially prevalent in children with cleft palate and frequently occurs in association with upper respiratory tract infection particularly adenoid and tonsillar infection

Material and methods: Total 160 patients were included in the study. A detailed history and clinical examination was done in a prepared questionnaire. Special emphasis was given to the following symptoms – nasal discharge, decrease in hearing, ear ache, ear discharge, defective speech, voice change, mouth breathing, snoring, sleep apnoea. Presence of following signs were noted – tonsillar grading, tympanic membrane retraction, tympanic membrane congestion, presence of fluid level, cholesteatoma, tympanosclerotic patch, retraction pocket. A pure tone audiogram was done to assess the hearing loss (if any). Tympanogram was done to assess the middle ear status. Examination under microscopy was done to confirm the otoscopic findings. Grading of adenoid tissue was done by flexible endoscopy

Results: Among the presenting symptoms the most common are mouth breathing, nose block and decreased hearing. The most common sign denoting middle ear effusion in our study is tympanic membrane retraction (58.1), followed by fluid level(23.1%). There is significant association between the presence of type B tympanogram and the presence of middle ear fluid.

Conclusion: Adenotonsillar hypertrophy acts as predisposing factors for otitis media with effusion. Adenoids cause tubal dysfunction by mechanical obstruction and reservoir for pathogenic organisms

Keywords: Adenotonsillar Hypertrophy, Otitis Media

INTRODUCTION

Otitis media with effusion, a term synonymous with secretory otitis media, serous otitis media, and glue ear, is one of the commonest chronic otological conditions of childhood. It results from alteration of the mucociliary system within the middle ear cleft and is frequently caused by malfunction of the eustachian tube. Serous or mucoid fluid accumulates within the cleft where there is a negative pressure. It is especially prevalent in children with cleft palate and frequently occurs in association with upper respiratory tract infection and generalised disorders such as allergic rhinitis, fibrocystic disease

The present study evaluate the relationship between the size of adenoid and tonsil with eustachian tube dysfunction and middle ear effusion.

This is evaluated

a. Clinically –symptomatic assessment and proper examination
b. Diagnostic nasal endoscopy- To assess the status of eustachian tube orifice and adenoid size
c. Intra operative findings- The status of middle ear (presence or absence of middle ear effusion), status of tympanic membrane etc are noted.

Infections of the middle ear space and their sequelae have plagued mankind from the beginning of time.Eustachian tube (ET) dysfunction is considered the major etiologic factor in the development of middle ear disease. Politzer first proposed the exvacuo theory of OM in 1867. The theory postulates that chronic negative pressure, secondary to ET malfunction, results in the development of a transudate into the middle ear space. Numerous experiments have been carried out by many authors to substantiate this theory. It is traditionally maintained that the effusion is sterile; therefore, therapy should be aimed chiefly at relieving ET dysfunction. The second etiologic theory was first suggested by Brieger in 1914 and proposes an inflammatory origin to OM. Since that time, several other authors have supported this theory.

Otitis media with effusion (OME) is the accumulation of serous or mucoid collection within the middle ear and sometimes the mastoid air cell system. Environmental factors, host factors, dysfunction of the eustachian tube, have been associated with otitis media with effusion.

Besides the actual pathogens, environmental factors have been shown in numerous epidemiologic studies to be strongly associated with increased prevalence of otitis media with effusion. These factors include bottle feeding, feeding while supine, having a sibling with otitis media, attending daycare, having allergies to common environmental entities, having a lower socioeconomic status, living in a home in which people smoke, and having a parental history of otitis media with effusion

Host factors include age, allergy, ciliary dysfunction, nasal

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and/or sinus disease, and immaturity of the immune system.[1] When we consider the influence of age the eustachian tubes of children are both smaller in diameter and more horizontally oriented than those of adults. As flow through a tube is inversely proportional to the fourth power of the radius, ventilatory function is considerably reduced in the child. The horizontal angulation and shorter length of the eustachian tube of the child favors reflux of nasopharyngeal contents into the middle ear with consequent inflammation and infection. With maturation, the eustachian tube assumes a more vertical position, which also serves to diminish proclivity for inflammation. [2]

Otitis media in the pediatric population is felt to be associated with allergy in 5 to 80% of cases. Inhalant allergies are felt to play a greater role than food allergies.A viral or bacterial infection may prime the environment, which, in response, produces inflammatory mediators[3]. These mediators begin the physiologic cycle, creating ET dysfunction, pressure gradients, and transudation of fluid.Eustachian tube dysfunction arise from inflammatory disorders, muscular abnormalities and anatomic factors.

When eustachian tube function was evaluated using a pressure chamber in children and adults who were considered otologically normal with intact tympanic membrane showed that only 5% of the adults were not able to equilibrate negative middle ear pressure, as many as 35.8% of the children could not equilibrate negative pressure. Children 3 to 6 years of age performed worse than children 7 to 12 years of age. These studies indicate that in even apparently otologically normal children eustachian tube function is worse than in adults, but it does improve with age. The improvement in the eustachian tube function parallels the decrease in the incidence of otitis media[4].

A study on the role of adenoidal obstruction in the pathogenesis of otitis media with effusion was done. Diagnosis of OME was made withfinding of type B tympanogram on tympanometry evaluation. The incidence of OME among adenoidal patients was compared with its incidence in normal control. The degree of nasopharyngeal obstruction among the adenoidal subjects was evaluated with an adenoidal-nasopharyngeal ratio parameter obtained from soft tissue radiograph of nasopharynx, and was related to the results of tympanometric evaluation of the adenoidal subjects. The incidence of OME was significantlyhigher in the adenoidal children than the normal control ($p < 0.001$). Gross nasopharyngeal obstruction was significantly associated with type B tympanogram ($p= 0.002$). The diagnosis of OME correlated significantly with the degree of nasopharyngeal obstruction ($r = 0.32$; $p = 0.002$). Their study found adenoid obstruction as a significant risk factor for OME in children. The risk of OME increases with the increasing degree of nasopharyngeal obstruction[5].

For radiographic evaluation of adenoidal size in children: adenoidal-nasopharyngeal ratio was done. Adenoidal-nasopharyngeal ratio (AN ratios) was obtained by simple linear measurements from lateral skull radiographs are described. The AN ratio reliably expresses adenoidal size and patency of the nasopharyngeal airway[6].

In a study 578 children 4 to 8 years old with chronic OME were grouped into four different groups and followed them for 2years. The myringotomy (M) group had the greatest amount of time with fluid (51weeks). TheA-M and A-M and T (myringotomy and tube) groups both had a lower percentage of time witheffusion (31 and 27 weeks), respectively than M and T alone (36 weeks). Thus, based on thes eresults and the lower incidence of otorrhea in subjects without tubes, Gates et al recommendedA-M as the “first line” procedure[7].

MATERIAL AND METHODS

This study was conducted in the department of ENT, Jubilee Mission Hospital, Thrissur. The study population was patientswho attended E N T department.

Inclusion criteria

(a)Patients with definite indications for adenoidectomy and/ or tonsillectomy

(b) Only those patient who gave consent to participate in the study were included

Exclusion criteria

(a) Patient who were not willing to give consent are excluded.

(b) Patients with definite contraindication for surgery (eg) cleft palate.

The study was conducted for a period of 18 months. 160 patients with adenotonsillar hypertrophy who were treated surgically from the Department of ENT, Jubilee Mission Hospital, Thrissur during this period were included in the study. The following observations were made and analysed

Study design – Detailed history and clinical examination was done in a pre prepared questionnaire. Eustachian tube function, tonsil size were noted. A standardized plain x-ray postnasal space (lateral view) was taken. The assessment of adenoid size is done by plotting adenoid shadow measured from standard bony points in a standardized x- ray to a graph paper. A pure tone audiometry was done to assess hearing loss and a tympanogram was done to assess the middle ear status. A direct nasal endoscopy was done to assess the status of eustachian tube orifice and adenoid size. Intra operative findings were be noted. All data collected were properly filed. Data was entered into EXCEL worksheet and checked for any correction and also to ensure quality of data

STATISTICAL ANALYSIS

Data analysis was done using appropriate statistical software. Appropriate tests like student t test of significance were used to bring out any association between the tested parameters.

RESULTS

In patients having repeated adenoidal and tonsillar infection and having definite indications for adenoidectomy and tonsillectomy the following observations are results are seen. In the study age ranged from 4 – 15 with a mean age of 8.45 of this 81% are males and 79% are females. The distribution of various symptoms are 45% having nasal discharge,73% with nasal block,52.5% with decreased hearing, ear ache

Grade	Frequency	Percentage
Grade 1	35	21.9
Grade 2	36	22.5
Grade 3	78	48.8
Grade 4	11	6.8

Table-1: Grading of adenoid tissue by flexible enoscopy

Adenoid X-Ray	No of patients			
	No hearing loss	Mild CHL	Moderate CHL and Above it	Total
Grade 1	31	4	0	35
Grade 2	10	18	8	36
Grade 3	22	32	24	78
Grade 4	2	5	4	11
Grade 5	65	59	36	160

Table-2: Adenoid endoscopy grading compared with conductive hearing loss

		Middle ear fluid level		Total
		No	Yes	
Adenoid endoscopy	Gr 1	33(94.26)	2(5.74)	35
	Gr 2	20(55.56)	16(44.44)	36
	Gr 3	45(57.69)	33(42.31)	78
	Gr 4	4(36.36)	7(63.64)	11
	Total	102	58	160

Table-3: Adenoid endoscopy grading compared with middle ear fluid level

in 48.8%, mouth breathing in 78.1% and snoring in 51.3%. Retracted tympanic membrane is present in 58.1% patients. One of the following signs also present in these patients are tympanic membrane congestion,tympanic membrane perforation,atopic tympanic membrane and cholesteatoma. Otoscopic findings are when tympanogram was done for all patients. Out of the 160, 71(44.375%) patients had type B tympanogram which is suggestive of fluid in the middle ear.Pure tone audiogram revealed conductive hearing loss in 50% patients.

Otoscopic findings

Tympanogram - Tympanogram was done for all patients. Out of the 160, 71(44.375%) patients had type B tympanogram which is suggestive of fluid in the middle ear. Out of this 71 patients 36 patients had bilateral B type graph (table-1).

Audiogram - Pure tone audiogram was done for all the patients. Out of the 160 patients 80 (50%) had conductive hearing loss. Out of this 80, 69 had bilateral conductive hearing loss and 21 had unilateral hearing loss. 4(2.3) patients had sensory neural hearing loss and 5 (3.125) had mixed hearing loss(one had bilateral mixed hearing loss (table-2).

The no of patients with conductive hearing loss in each group were calculated (table-1,2,3).

Grading of adenoid tissue was done by flexible endoscopy

A classification of adenoid size has been described by Clemens et al.

Grade I- Adenoid tissue filling one-third of the vertical portion of the choanae

Grade II- Adenoid tissue filling from one-third to two-thirds of the choanae

Grade III- From two-thirds to nearly complete obstruction of the choanae

Grade IV- Complete choanal obstruction

DISCUSSION

By definition Otitis media with effusion (OME) is the accumulation of serous or mucoid collection within the middle ear and sometimes the mastoid air cell system.

An estimated 90% of children will have had at least one episode of acute OM by the age of 7. OM is both the most common childhood disease for which medical attention is sought and the most common indication for surgery, resulting in annual cost in the billions of dollars

In our study maximum number of patients was seen in the age group of 5-10 years. This is in consistence with previous study by Dawes**.** [9] Out of the 160 patients studied, 81 were males and 79 were females. There are no definite reports in literature stating that sex of the patient affects the disease pathology.The most common complaint in our study was mouth breathing (78.1%), followed by nose block (73%) and decreased hearing (52.5%).

In another study of 817 children by Dawes most common symptom was nasal obstruction followed by snoring. This is not consistent with our study. Otoscopy represents the most critical part of the examination to establish the diagnosis of OM. Use of the pneumatic otoscope is essential. An adhesive tympanic membrane was seen in 27(16.62%) patients.

The existence of chronic middle ear effusion is most easily confirmed when there is a definite air-fluid level or when bubbles are clearly visible within the middle ear space. In our study 37 patients (23.125%) showed a definite air fluid level on otoscopy. Microscopic examination revealed that 59 (36.25) patients showed a definite fluid level.

However, findings commonly associated with OME include a severely retracted tympanic membrane with apparent foreshortening of the handle of the malleus and a reduction in tympanic membrane mobility. In our study 93 (58.125%) patients had retracted tympanic membrane on otoscopy and microscopic examination revealed that 97 (60.625%) patients showed a definite fluid level. The color of the tympanic

membrane is important but is not conclusive in making a diagnosis. An erythematous tympanic membrane alone may always be indicative of a pathologic condition because the vasculature of the tympanic membrane may be engorged as a result of the patient's crying. In our study 9 (5.625%) children had congested tympanic membrane on otoscopy.

In the present study also when analyzed using a chi square test a very significant association was found between type B tympanogram to the presence of middle ear fluid (p value = 0.00031) and retraction of tympanic membrane (p value = 0.0462).

Hence we can conclude from our study that tympanogram can be used as a predictor for middle ear effusion.

Also co-relation study showed that significant co-relation occurs between type B tympanogram and the following symptom nasal discharge (p value <0.000), nose block (p value <0.000), hearing loss (p value <0.000), defective speech development (p value <0.000), ear ache (p value <0.000), ear discharge (p value <0.000), and mouth breathing (p value <0.000). No significant co-relation was found between type B tympanogram and snoring (p value <481), and apneas (p value <0.054).

In a study conducted by Orchik and et al in which he assessed Tympanometry as a predictor of middle ear effusion a type B tympanogram compared with all other types of tympanogram has a sensitivity of between 56 and 73 percent and a specificity of between 50 and 98 percent in detecting OME confirmed surgically. [10]

The hearing pattern in our study showed that 50% of patients had conductive hearing loss. Both sensory neural and mixed hearing loss together constituted to upto 5%.

Also co-relation study showed that significant co-relation occurs between conductive hearing loss and the following symptom nasal discharge (p value <0.000), nose block (p value <0.000), hearing loss (p value <0.000), defective speech development (p value <0.040), ear ache (p value <0.000), ear discharge (p value <0.000), and mouth breathing (p value <0.000).

No significant co-relation was found between snoring (p value <0.134), and apneas (p value <0.574).

Assessment of airway from x ray soft tissue neck lateral view for adenoids

The amount of obstruction was categorized into 4 grades from x-rays. As grade increases airway compromise increases. Also as grade increases there high chance of Eustachian tube block.

In each group the patients were again sub divided to normal hearing, mild conductive hearing loss and above. It is seen that as the size of adenoid (grade as indicated by x-ray) increases there is definite increase in no of patients with conductive hearing loss. Chi square test was applied and it was found that there is significant association between the degree of hearing loss and adenoid size calculated from x-ray (p value =0.00019). Thus we can conclude that in this study adenoid size is an important factor in determining the degree of hearing loss.

Patients in each group were again sub divided according to the type of tympanogram result. Chi square test was applied and it was found that there is significant association between the increase in adenoid size as calculated from x-ray and type B tympanogram (p value =0.0006). Thus we can conclude that in this study adenoid hypertrophy as indicated by x-ray is an important factor in determining the presence of fluid in middle ear.

Also patients in each group were subdivided according to the presence or absence of middle ear fluid. 10.8% of patients in grade 1 had middle ear fluid. Similarly 47.3% in grade 2 and 39.78% in grade 3. Thus we can see that as the size of adenoid increases (as indicated by grade) there is definite increase in the no of patients with a fluid level in middle ear.

Patients in each group were again sub divided according to the type of tympanogram result. Chi square test was applied and it was found that there is significant association between the increase in adenoid size as calculated from endoscopy and type B tympanogram (p value =0.0008). Thus we can conclude that in this study as adenoid size as indicated by x-ray is an importantfactor in determining the presence of fluid in middle ear.

Also patients in each group were subdivided according to the presence or absence of middle ear fluid. 10.8% of patients in grade 1 had middle ear fluid. Similarly 47.3% in grade 2 and 39.78% in grade 3. Thus we can see that as the size of adenoid increases (as indicated by grade in endoscopy) there is definite increase in the no of patients with a fluid level in middle ear.

Patients in each group of adenoid hypertrophy were inspected to see the presence of fluid level. In grade 1 hypertrophy 5.74% showed a definite fluid level. 44.44% in grade 2, 42, 31% in grade 3and 66.67% in grade 4. So higher the grade higher the chance of getting a fluid level.

CONCLUSION

Otitis media with effusion is a very common childhood disease. Incidence is much higher in children with adenotonsillar hypertrophy. One of the most common risk factor is the age of the patient, affecting the child's hearing at the most critical age. As age advances incidence decreases. Tympanogram can be used as a effective screening tool in determining the presence of middle ear fluid. Early detection through screening programs followed by immediate proper treatment is the best known effective measures to fight this disease.

Adenoids and tonsil acts as predisposing factors of otitis media with effusion.

Adenoids cause tubal dysfunction by:

i. Mechanical obstruction of the tubal opening.
ii. Acting as reservoir for pathogenic organisms.
iii. In cases of allergy, mast cells of the adenoid tissue release inflammatory mediators which cause tubal blockage.

Enlarged palatine tonsils mechanically obstruct the movements of soft palate and interfere with the physiological opening of eustachian tube. The increase in the size of palatine tonsil doesn't cause any significant middle ear effusion (as evident by tympanogram, audiogram and the

presence of middle ear fluid). Where as the adenoid size as measured from both adenoid x-ray and adenoid endoscopy showed a significant association with the presence of middle ear effusion.

REFERENCES

1. Coticchia J, Zuliani G, Coleman C, et al: Biofilm surface area in the pediatric nasopharynx: chronic rhinosinusitis vs obstructive sleep apnea. Arch Otolaryngol Head Neck Surg 2007; 133(2):110-114.
2. Darrow D, Siemens C. Indications for tonsillectomy and adenoidectomy. Laryngoscope 2002; 112(8 Pt 2 Suppl 100): 6–10.
3. Healy GB, Smith HG. Current concepts in the management of otitis media with effusion. Am J Otol 1981; 2:138–44.
4. Phillips DE, Bates GJ, Parker AJ, Griffiths MV, Green J. Digital and mirror assessment of the adenoids at operation. Clinical Otolaryngology and Allied Sciences. 1989; 14: 131-3.
5. Christopher J. Linstrom, Carol A. Silverman, Arie Rosen, Eustachian Tube Endoscopy in Patients With Chronic Ear Disease The Laryngoscope, 2000,
6. Babak Saedi, Mohammad Sadeghi, Mohammad Mojtahed Pediatric otolaryngology: principles and practice Diagnostic efficacy of different methods in the assessment of adenoid hypertrophy,American Journal of Otolaryngology–Head and Neck Medicine and Surgery 2011; 32:147–151.
7. Gates GA, Avery CA, Prihoda TJ, Cooper JC Jr. Effectiveness of adenoidectomy and tympanostomy tubes in the treatment of chronic otitis media with effusion. N Engl J Med 1987; 317:1444–1451.
8. Ren DD, Wang WQ.: Assessment of middle ear effusion and audiological characteristics in young children with adenoid hypertrophy. Chin Med J (Engl). 2012; 125(7):1276 81.
9. Dawes JDK. The aetiology and sequelae of exudative otitis media. J Laryngol Otol 1970; 84:583-610.
10. Orchik OJ, Dunn JW, McNutt L. Tympanometry as a predictor of middle ear effusion. Archives of Otolaryngology. 1978; 104: 4-6.
11. Cassano P, Matteo G, Cassano M, Fiorella M-L, Fiorella R. Adenoid tissue rhinopharyngeal obstruction grading based on fibrendoscopic findings: a novel approach to therapeutic management. International Journal of Pediatric Otorhinolaryngology. 2003;67:1303-09.

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