

Original Article

Middle Ear Pressure Changes after Adenotonsillectomy and Myringotomy in Patients with Otitis Media with Effusion

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Abstract:

Background: Otitis media with effusion (OME) is a common ear problem among children characterized by accumulation of secretion in the middle ear. The pathophysiology of OME is negative pressure due to eustachian tube dysfunction. In children adenoid enlargement is associated with enlargement of the tonsils. Surgical treatment is advocated when conservative treatment fails. Surgical treatment consists of adenotonsillectomy with myringotomy. Negative middle ear pressure is expected to improve after surgical intervention.

Objectives: To see the pressure changes after surgical treatment of OME.

Methods: Among 68 subjects with OME, 88 ears were operated. Adenotonsillectomy was done in all subjects. In addition myringotomy was done in 65 ears and myringotomy with grommet insertion was done in 23 ears. In post-operative period all patient were followed up at end of 1 month, 3 month and 6 month with tympanometry.

Results: Pre operatively type B tympanogram was 67(76.13%) whereas type A tympanogram was 0(0%). At end of 6 month type A curve was 49(61.27%) and type B tympanogram was 9(11.25%) that indicates improvement of middle ear function after operation.

Conclusion: Tympanometric improvement was significant after 6 month of surgery.

Key words: OME, Middle ear pressure, Tympanometry, Impedance

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Introduction:

Otitis media with effusion (OME) is a pathologic condition of the middle ear in which an effusion is present behind an intact tympanic membrane without signs of acute inflammation. It results from alterations of the mucocilliary system within the middle ear cleft and is frequently caused by dysfunction of the eustachian tube. This problem is prevalent in children and frequently found in association with upper respiratory tract infection and other disorders like cleft palate¹.

Normal middle ear pressure should be somewhere between +200 to -99 daPa.

There are different types of tympanograms, which reflect the middle ear pressure. Type A pattern is a sharp peaked pattern with the peak somewhere between +200 to -99 daPa. Type B tympanogram shows as a flat line on the graph. A middle ear cavity that contains a large effusion instead of air will reflect most of the sound energy backward and have a flat line type B tympanogram. Type C tympanogram is similar to type A but the peak is to the left of normal pressure or in other words more negative than -99 daPa when it indicates extreme eustachian tube dysfunction. It is divided into Type C1 (-100 daPa to -199 daPa) & Type C2 (-200 daPa to -399 daPa). Abdullah *et al.* (2007) showed that commonest presenting symptom was hearing impairment (52%) while the most common otoscopic finding was fluid in the middle ear (40%). Audiologically, the hearing impairment ranged from mild to severe of which moderate conductive hearing loss being the highest (48%) while most patients showed flat type B curve (84%)¹. On myringotomy middle ear fluid was found in 76 % of the ears. The improvement of tympanogram post adenoidectomy at 3rd and 6th months was statistically significant². Adenoid hypertrophy is associated with increased negative pressure in the middle ear. They believed that it is necessary to perform the middle ear examination and tympanometry in children before adenoidectomy and in children without parental suspicion of hearing loss, even. But there are cases in which despite adenoidectomy, the middle ear effusion persists because of the anatomical and physiological peculiarities of eustachian tube in children³. In all those cases other medical measures tympanotomy, tympanostomy tubes should be taken⁴. In case of normal middle ear pressure, temporary eustachian tube dysfunction and aural fullness occur in the early period after adenoidectomy and/or adenotonsillectomy. This temporary eustachian dysfunction has been believed to be caused by post-surgery clots and edema⁵.

Persistent negative pressure is the main cause of chronicity and recurrence of OME. As OME is multifactorial and so its surgical options are also like combination of adenoidectomy with myringotomy, adenoidectomy with ventilation tube insertion. Adenoidectomy in combination with ventilation tube insertion or myringotomy showed impressive results on improvement of middle ear function of the child. Main function of ventilation tube is to ventilate of middle ear. Aim of this study was to see returning negative middle ear pressure to normal after surgical treatment of OME. If negative pressure persists it may cause re-effusion or hamper the normal physiologic function of ear and may cause hearing impairment as well as problem in speech and language development. This study can give a guideline of duration for follow up the patient in post-operative period. This study is an endeavour to mitigate the gap and assess the relationship between surgical intervention for OME and normalization of middle ear pressure.

Methods:

This prospective study was conducted in Department of Otolaryngology-Head & Neck Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka from July 2015 to June 2017. 68 Cases of chronic OME with adenoids undergoing surgery in the Department of Otolaryngology-Head & neck surgery, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka were included in this study.

Study Procedure:

History taking and thorough Ear, Nose, Throat examination and related systemic examinations were done for each patients. Related investigations (tympanometry) were done before operation. In post-operative period all patient were followed up at 1st, 3rd and 6th month. In follow up clinical examination, tympanometry were done. Data was collected and analyzed by Statistical analyses were carried out by using the Statistical Package for Social Sciences version 24.0 for Windows

(SPSS Inc., Chicago, Illinois, USA). A descriptive analysis was performed for all data. The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Test parameters were documented as per at end of 1 month, 3 month and 6 month. Paired t test was used to see significance of hearing & pressure improvement. Wilcoxon sign rank test was done for tympanometric analysis.

Results:

Total 68 patients were included. Among them more than half 41(60.3%) patients belonged to age 61-72 months. The mean age was found 76.44 ± 15.2 months with range from 61 months to 120 months. Almost two thirds patients 42(61.8%) were male and 26(38.2%) patients were female. 52 (76.5%) patients had history of illness 6 month or less and 16 (23.5%) had more than 6 month duration of illness.

Table I:

Distribution of the study subjects by age, sex and duration of illness (n=68)

	Number of patients	Percentage
Age (months)		
61–72	41	60.3
73–84	16	23.5
85–96	5	7.4
97–108	2	2.9
> 108	4	5.9
Mean±SD	76.44±15.2	
Range (min, max)	61,120	
Sex		
Male	42	61.8
Female	26	38.2
Duration of illness (months)		
≤6	52	76.5
>6	16	23.5
Mean±SD	5.34±1.65	
Range (min, max)	3,9	

All study subjects underwent adenotomyllectomy. In addition almost three fourths 65(73.9%) ears had myringotomy and 23(26.1%) ears had myringotomy with grommet insertion

Table II:

Distribution of the study ears by type of operation (n=88)

Type of Operation	Number	Percentage of ears
Myringotomy	65	73.9
Myringotomy with grommet insertion	23	26.1

During operation grommet of short duration was inserted in 23 ears. At the end of six month almost two third 15(65.2%) grommets were extruded and grommets were remained in situ in 8(34.8%) ears.

Table III:

Distribution of the study ears by status of grommet at end of 6 months (n=23)

Status of grommet	Number	Percentage of ears
Grommet extruded	15	65.2
Grommet not extruded	8	34.8

Middle ear pressure and compliance were evaluated in pre and post-operative period by follow up tympanogram. Type A (normal tympanogram) was nil in pre-operative period that was increasing gradually in post-operative period, at end of 1 month type A curve was 13(20%), at end of 3 month it was 33(50.8%), at end of six month it was 49(61.27%). On contrary, Type B tympanogram (abnormal pressure) that is for OME was decreasing in post-operative period. Type B was 67(76.13%) in pre-operative period that was decreasing gradually in post-operative period. At the end of 1 month type B curve was 22(33.85%), at the end of 3 month it was 13(20%) and at the end of six month it was 9(11.25%). This change was significant at the end of six month.

Table IV:
Distribution of the study ears by Tympanogram

Tympanogram	N	Type A		Type B		Type C1		Type C2	
		n	%	n	%	N	%	n	%
Pre-operative	88	0	0.0	67	76.13	3	3.4	18	20.45
Post-operative at 1 month*	65	13	20.0	22	33.85	16	24.61	14	21.54
Post-operative at 3 month*	65	33	50.8	13	20.0	8	12.3	11	16.92
Post-operative at 6 month**	80	49	61.27	9	11.25	22	27.5	0	0.0

*Note: A total of 23 cases were on grommet at 1month and 3month of follow-up

** A total of 8 ears could not extruded grommet at the end of 6 month.

Comparison Group	P value
Pre -operative vs at 1 month post-operative tympanogram	0.466
Pre -operative vs at 3 month post-operative tympanogram	0.061
Pre -operative vs at 6 month post operativetympanogram	0.0001

*p*value was obtained from wilcoxon sign rank test

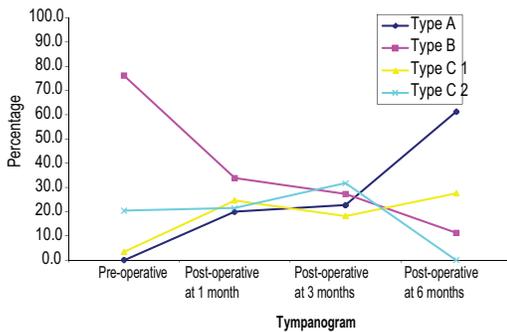


Fig.-1: Line diagram shows percentage of different types of tympanogram in pre and post operative period.

It revealed that in post operative period progressive increasing frequency of Type A curve and decreasing frequency of type B curve. Type C2 curve was decreasing also. Type C1 curve was persisting in 27.5% ears.

Discussion:

OME is a very common disease during childhood frequently found in daily practice. It is characterized by the presence of fluid in

the middle ear without signs of an acute infection. In children it is due to eustachian tube dysfunction, mostly due to enlarged adenoid. The disease causes mouth breathing, nasal obstruction, snoring and hearing loss. If persists it may cause delayed language and speech development⁶. The presentation of OME fluctuates according to its severity. When latent in infants and young children it may present with impaired speech, language development and scholastic retardation. Otagia often occurs frequently in a recurrent form results from secondary infection of the fluid within the middle ear cleft. It is frequently coincides with cold attack or minor upper respiratory tract infections but occasionally followed sinus infection or an episode of allergic rhinitis⁷.

Current prospective study of 68 cases of adenoid hypertrophy with OME was studied to assess the effect of adenoidectomy and myringotomy ± grommet insertion in improvement of hearing and middle ear pressure. OME was diagnosed by history,

otoscopic finding and conductive hearing loss on PTA and impedance changes by tympanogram. In this study, most of the patients presented with nasal obstruction 68(100%), followed by mouth breathing 55(80.9%), snoring 51(75%), hearing loss 14(20.6%) and aural fullness 14 (20.6%). Current study included children of age 6-12 years. Majority was in the age group of 6-7 years and the mean age was 6.3 years. There was a study on age group 5-15 years². Majority was in the age group of 5-10 years and the mean age was 7.48 years that was more than current study There was male preponderance (male & female ratio 1.6:1). However, there was no apparent gender based difference in the incidence of OME⁸

Included patients in this series were more from rural than urban. This study was done in apex hospital of the country so real geographical distribution was not possible to find out. From previous study OME was more common in rural area specially in slums but in this study no cases was from slum. Differences in OME rate by race and place may reflect differences in access to the medical care, the socioeconomic status and the anatomic or biologic susceptibility though it is common in crowded place⁷.

In previous study, the adenoid appeared to be at its largest in the seven years old age group⁹. In this study, most of the patients were in 6-8 years of age and most of them had grade II and grade III adenoids. The enlarge adenoid in this series was grade I-0(0%), grade II-27(39.7%), grade III-24(36.8%) and grade IV-16(23.5 %) that was nearly similar to the percentages reported in the literature¹⁰. Myringotomy was done in 65(73.9%) ears and myringotomy with grommet insertion was done in 23(26.1%) ears. Grommets were remained in 8 ears at the end of 6 months so tympanometry was not possible to do in those cases.

The type of fluid found in the middle ear during myringotomy in cases of OME varied from a thick mucus glue like secretion to thin serous fluid. Analysis of the constituents of the effusion showed that the viscosity is correlated with the concentration of mucin¹. Different types of effusions because of various levels of enzymes and proteins correlated with recurrent cases of OME¹¹ whereas another study insisted that the type of effusion found on aspiration in myringotomy had no prognostic value⁹. In this study glue ear 23(26.13%), serous 55(62.5%). Presence of glue ear may be related to long duration of OME.

Tympanometric curves were assessed in many studies according to the classification system of Jerger. Tympanometry provides useful information about the presence of fluid in the middle ear. Usually, tympanometry is more easily performed than otoscopic examination in children¹².

In current study more than three fourths 67(76.13%) curves were type B, type C1 was 3(3.4%), type C2 was 18(20.45%) pre operatively. In post-operative period type B curve decreased in number gradually and at end of six months only 9(11.25%) ears had type B curve. It might be due to residual disease or thickened tympanic membrane. In the same way negative pressure indicating curve type C became less in number and type C2 became nil at end of 6 month. On contrary type A curve was nil initially and increased in number in post-operative period. At end of 6 month type A curve was 49(61.27%). This improvement of tympanogram was statistically significant (P value <0.01). But at the end of 1 month and 3 month the p value were 0.466 and 0.061 respectively that were not significant. It was stated that type B curve were 84% pre operatively that was near to current study¹³. In post-operative follow up it was revealed that improvement of

tympanogram at 3rd and 6th month that were statistically significant. In that study, pre-operative type B tympanograms were present in 54% ears that were less than current study and at end of 6 month 8% ears had type B curve, 25% ears had type A curve and rest 67% ears had type C curve. More number of pre-operative type B curves in current study might be the cause of insignificant result at end of 1 and 3 month².

Conclusion:

OME is common childhood problem. It demands early attention as it may lead to hearing impairment, impaired speech, language development and scholastic retardation. Tympanometric improvement was significant after 6 month. Hence adenoidectomy with myringotomy ± grommet in children having hypertrophied adenoid with OME prevents grave consequences.

Recommendations:

1. Further studies on large sample size will be required to strengthen this knowledge.
2. Aware the parents about the early symptoms of OME.
3. Special emphasis should be given in school health clinic for early diagnosis of OME.
4. Tympanometry can be used in screening program to detect OME.
5. Follow up of OME patients should be prolonged even after surgery.

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