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Original Article

Effects of Enlarged Adenoids on Middle Ear Pressure and Hearing

Md. Saber Ali,[1] Md. Enamul Haque[2]

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Abstract

Introduction: *Enlarged adenoid was diagnosed in 52 (1.15%) cases of children under15 years of age with variable size reducing nasopharyngeal space to a various degree. Relative size of adenoid or its extension laterally may obstruct pharyngeal opening of eustachian tube resulting significant changes to negative middle ear pressure and hearing impairment. The aim of this study was to assess the morbidity in children and adolescent resulting from unwanted effects of enlarged adenoid on middle ear pressure and hearing.*

Methods: *This study was done to indentify middle ear pathology. Patients were from out patient department of Rajshahi Medical College Hospital, January to December 2004. Total 52 patients were included both male and female sexes of age ranging from 3-15 years belong to different socio-economic conditions, children of middle socio-economic status taking unbalanced diet, living overcrowded on kacha floor shown higher incidence of enlarged adenoids. Patients were diagnosed as having enlarged adenoid from history, clinical examination & X-ray nasopharynx lateral view was done in all cases. Tuning fork test, pure tone audiometry and impedance audiometry (Tympanometry) were also done.*

Results: *Significant number of cases 27 (51.92%) having hugely enlarged adenoid between age group 6-10 years were observed.*

Conclusion: *This study was done to develop awareness about the effects of enlarged adenoid on hearing and speech by proper health education and primary health care measures. It reduces the risk of orthodontic architectural deformity by early diagnosis and treatment.*

Key words: *Adenoids, Middle ear pressure, Hearing*

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1. *Associate Professor, Ear, Nose and Throat Department, North Bengal Medical College, Sirajganj*
2. *Assistant Professor, Ear, Nose and Throat Department, Rajshahi Medical College, Rajshahi*

Correspondence *Md. Saber Ali, Email: saberalient@gmail.com*

Introduction

Nasopharyngeal tonsils are three in number, one of them is situated in the midline at the junction of posterior pharyngeal wall and roof of the nasopharynx. When that is enlarged and produces symptoms, then it is regarded as adenoid.[1] Mildly enlarged adenoid means soft tissue shadow occupying less than $^{1}/_{3}^{rd}$ of the space in nasopharyngeal air column. Moderately enlarged adenoid occupies more than $^{1}/_{3}^{rd}$ but less than $^{2}/_{3}^{rd}$ space in the nasopharyngeal air column. But hugely enlarged adenoid refers to a size more than $^{2}/_{3}^{rd}$ space is occupied by soft tissue shadow.[4] Others two are tubal tonsils placed at posterior aspect of pharyngeal openings of eustachian tubes connecting middle ears to nasopharynx. Lateral extension or enlargements of adenoids produce nasal and / or aural symptoms due to reduction of nasopharyngeal space and / or obstruction to pharyngeal opening of eustachian tube. Commonly affected group is children and adolescent age ranging from 3 to 15 years with insignificant male: female ratio. Variable degree of nasopharyngeal space reduction from various degrees of enlarged adenoids and air column versus soft tissue shadow ratio measured by radio-image study. Nasopharyngeal space measured from basi-occiput to soft palate of its narrowest part. Various degree of adenoids enlargement measured by Adenoidal: Nasopharyngeal space ratio.[10]

Ill effects of enlarged adenoid on middle ear pressure and different pathological changes as otitis media with effusion (OME), chronic supporative otitis media (CSOM) even persistent residual changes in tympanic membrane. The aim of this study is to reduce morbidity in children and adolescent resulting from unwanted effects of enlarged adenoids on middle ear pressure and hearing. This affects speech development, social communication, education and impaired mental growth. It also causes orthodontic deformity due to nasal breathing obstruction.

Material and Methods

All children age between 3 to 15 years, were collected from out patient department (OPD) of Ear, Nose and Throat (ENT) department of Rajshahi Medical College & Hospital from January to December 2004 and diagnosed as having enlarged adenoid through a prescribed protocol by proper history taking and physical examinations. All cases X-ray nasopharynx lateral view and others relevant investigations were done. Middle ear status was assessed by Tuning Fork test, Pure-tone audiometry (PTA), impedance audiometry (Tympanom-etry) and pathological changes were correlated with degree of adenoidal enlargement. Pressure changes assessed by Tympanometry, normal intra-tympanic pressure is -100 mm of H_2O to +50 mm of H_2O, below -100 mm of H_20 to -200 mm of H_2O will be regarded as negative middle ear pressure. Normal compliance is 0.39 ml – 1.30 ml. Hearing impairment assessed by Tuning Fork test but its degree of hearing

loss measured by PTA. Mild hearing loss is labeled as 30 deciBell (dB) to 45 dB. Moderate hearing loss means 46 dB to 60 dB but severe loss is 61 dB to 90 dB. A patient described as totally deaf with hearing loss above 120 db which is beyond the maximum output of an audiometer. Tuning Fork test assess qualitative aspect indicated by Rinne's test negative and weber's test lateralised to the affected ear, patient having conductive hearing loss.

Results

Out of 4550 children under 15 years age ranging between 3-15 years were examined in ENT, out patient department (OPD) of Rajshahi Medical College and Hospital. Out of them 52 were diagnosed as having enlarged adenoid, produced various symptoms most common was open mouth breathing and others shown in Table I.

Table I: Presenting symptoms with number and percentage of Patients (n–52)

Symptoms	Number of patients	Percentage
Mouth breathing	34	65.38
Hearing impairment	27	51.92
Snoring	23	44.23
Nasal blockage and discharge	20	40.38
Dribbling of saliva	18	34.61
Persistent ear discharge	13	24.99
Bed wetting	10	19.38
Sleep disturbance	08	15.38
Epistaxis	06	11.53
Voice change and cough	06	11.52
Headache	05	09.61

Presence of various sizes of adenoidal enlargement with their percentage distribution is shown in Table II.

Table II: Different sizes of enlarged Adenoids and their percentages (n - 52)

Sizes of Adenoids	Numbers	Percentage
Hugely enlarged	27	51.92
Moderately enlarged	22	42.31
Mildly enlarged	03	05.77

Typical adenoid facies was found in one male patient (1.92%). Age and sex distributions were studied and found 28

(53.84%) in male and 24 (46.16%) in female children. But the age range varies from 3-15 years, among which 10 (19.23%) were between 3-5 years, 35 (67.31%) between 6-10 years, and 7 (13.46%) were above 10 years (Table III).

Table III: Age and sex distribution of Patients (n-52)

Age in years	Sex		Total	Percentage
	Male	Female		
	28	24		
3-5 Years	05	05	10	19.23
6-10 Years	19	16	35	67.31
Above 10 Years	04	03	07	13.46

Male: female ratio with prevalent age group is 1.66: 1.

In this study, clinically it was revealed that, middle ear pathology were in the form of OME 62 (59.62%), CSOM 26 (24.99%) unilaterally or bilaterally or combined in the same patient. There was overlapping found in patient of OME in one ear and CSOM in other ear (Table IV).

Table IV: Percentage of various Middle Ear Pathology (n – 104 ears)

Clinical diagnosis	Number of ear affected	Percentage of ear affected
OME (otitis media with effusion)		
Bilateral	32	30.78
Right Ear	16	15.38
Left Ear	14	13.46
Total	**62**	
CSOM		
Bilateral	14	13.47
Right Ear	07	06.73
Left Ear	05	04.80
Total	26	
Normal Ear	16	19.59
Total	**104**	

Of the OME majority showed mild to moderate hearing loss ranging from 40-60 dB. Pure-tone Audiometry changes were correlated with clinically diagnosed

conditions. Test (PTA) was not done in 6 cases (12 ears). In Clinical findings, PTA and Tuning Fork test were correlated in Table V.

Table V: Correlation of clinical findings, PTA and Tuning fork tests (n-104)

Ears Involved	Suspected hearing loss on clinical findings (n-104)	Hearing loss found by pure-tone Audiometry (n-92)	Normal hearing by Audiometry test (n-92)	Hearing loss found by Tuning Fork test (n-92)
Bilaterally affected Ears	44 (42.31%)	40 (43.48%)	8 (8.69%)	20 (21.73%)
Right Ear	23 (22.12%)	20 (21.74%)	4 (4.35%)	14 (15.21%)
Left Ear	21 (20.19%)	16 (17.39%)	4 (4.38%)	10 (10.86%)
Total	**88 (84.62%)**	**76 (82.61%)**	**16 (17.39)**	**44 (47.8%)**

Ears with intact but abnormal looking retracted ear drum and a few normal looking drum were mostly subjected to impedance audiometry and flat curve obtained in 44 (66.66%) ears, rest showing normal tympanogram 22 (33.34%). Tympanometric abnormality indicating pressure changes in the middle ear cavity. Pressure changes observed in 50 (75.76%) ears of which 46 (69.69%), showing negative pressure 4 (6.07%) showing positive pressure and 16 (24.24%) has shown normal pressure. Six cases were dropped out and clinically established CSOM also excluded from Tympanometric investigations. As the pressure gradient could not be created due to lack of sealing mechanism, the test results correlated in Table VI.

Table VI: Correlation between clinical and tympanometric findings (n – 66)

Total number Ears (n -104)	Clinically abnormal ear drum (TM)		Impedence audiometric Curve
	Intact - 62	Perforated - 26	Flat-Curve - 44
Bilateral	32 (30.78%)	14 (13.47%)	22 (33.33%)
Right	16 (15.38%)	7 (6.73%)	12 (18.18%)
Left	14 (13.46%)	5 (4.8%)	10 (15.15%)

Clinically in 16 (15.38%) cases, normal tympanic membrane (TM). Were observed Pressure changes in the middle ear were observed by Tympanometry (Table VII).

Table VII: Tympanometry showing pressure changes in the middle ear (n-66)

Tympanometric pressure change	Numbers of ears	Percentage	Total numbers of ears affected
Negative pressure 46	Bilateral = 24	36.36%	75.76%
	Right = 12	18.18 %	
	Left = 10	15.15%	
Positive pressure 4	Bilateral = 2	3.03%	
	Right = 1	1.52%	
	Left = 1	1.52%	
Normal pressure 16	Bilateral = 8	12.12%	24.24%
	Right = 4	6.06%	
	Left = 4	6.06%	

Comparative study of the effects of enlarged adenoids on middle ear pressure and hearing is shown in Table VIII.

Table VIII: Correlation between pressure change and hearing loss (n-92)

Only pressure change (n-66)	Only hearing loss (n-92)	Both pressure change and hearing loss	Total number of ears affected	Normal
50 (75.76%)	76 (82.61%)	76 (82.61%)	76 (82.61%)	16 (17.39%)

Discussion

In this study, enlarged adenoid was found in 1.15% children under 15 years of age. The patients were collected from hospital of national referral level reflecting actual picture of the problem prevailing in the country. Majority of the patient presented with more than one symptom and the commonest symptoms was open mouth breathing, 34 (65.38%). Others symptoms included hearing impairment 27 (51.92%), snoring 23 (41.23%), nasal blockage and discharge 28 (40.38%). These mentioned findings were consistent with the findings of others reseachers.[1-4,7,15] Persistent discharge, epistaxis, cough and voice change, headache were found in 24.99%, 15.83%, 11.63% and 9.61% respectively. The symptoms were due to mechanical obstruction and associated secondary infections. Excessive salivation and dribbling of saliva 18 (34.61%) due to the fact that patient keep their mouth open to maintain airway. Excessive salivation and dribbling may occur due to persistent

exposure to environmental irritant. Sex incidence in this study were found 28 (53.80%) in male and 24 (46.20%) in female children. This incidence is similar to many other previous study.[1,3,16]

The highest incidence of 67.31% cases was between the ages of 6-10 years, which is inconsistent with the findings of others, where age incidence of enlarged adenoid found 3-6 years.[16] But this age incidence is quite consistent with many others who said adenoids were highest at the age of 6-8 years there after it regresses.[12] The late presentation is due to illiteracy, lack of knowledge about their problems and modern treatment and also receiving some traditional treatment for fear of operative procedure.

The present study revealed significant role of overcrowding, most of the children taking unbalanced diet are predisposing factors which causes enlarged adenoid due to recurrent upper respiratory tract infection. Incidence is higher among the children in a family having their number more than two. Behavioral study in this series showed stubborn nature due to deafness from OME, CSOM caused by enlarged adenoid.[7-9,20] Poor responses and performance at classes may be due to reduced mental alertness[16] and impaired hearing[18] caused by enlarged adenoid which is consistent with other.[4]

Examination of nasal cavity and paranasal sinus revealed no significant changes except nasal discharge possible from mechanical effects of enlarged adenoid and secondary infection. Also concomitant tonsillar enlargement was not observed indicating that their might be some factor other than immunological response causing preferential enlargement of adenoid.[14, 15]

Clinically, out of 104 ears 52 patients were examined by Pure-tone audiometry (PTA), and Impedance audiometry (Tympanometry) [5] were done in 92 ears (46 children) in present series. Conductive type of deafness was expected in 84.62% due to middle ear pathology. But it was found 47.74% by tuning fork test[6] (Rinne's test –ve, Weber's test lateralized to affected ears) & 82.61% by PTA, clinically otitis media with effusion (OME) was seen 59.62% but flat curve obtained by impedance audiometry in only 44 (66.66%) ears.

Inconsistency between clinical findings and test results may be due to facts that:

I. Non-cooperation due to inattention to test also poor intelligence.
II. Clinical examination done but test was not done in all cases.
III. Mild middle ear pathology like OME, retraction might not interfere middle ear compliance and hence hearing mechanism might remain unaffected.[19]

Ear findings in a significant 88 (84.62%) number in this study indicate an important

relationship between enlarged adenoid with middle ear pathology, of which OME 62 (59.62%) and CSOM 26 (24.99%) are common diseases. Reasonable percentage of CSOM in this series inconsistent with the findings of other authors.[11] In this series, comparative studies showed that the moderate to hugely enlarged adenoids involving ears mostly hearing loss 76 (82.61%) and pressure changes 50 (75.76%) in the middle ears. These changes mostly followed by right ear and least affected left ear. Bilateral involvement was due to extensive enlargement of adenoid tissue from midline interfering the tubal functions.[13] Right side was affected more than the left due to posture or disproportionate extension of adenoid behind right Eustachian tube.[20]

Negative middle ear pressure is due to enlarge adenoid causing mechanical obstruction to the eustachian tube resulting absorption of middle ear gases which is consistent with study of others.[2,10] Positive middle ear pressure was due to auto-inflation, excessive crying, swallowing, movement of soft palate and position the mouth which is similar to others.[17] Retraction of ear drum due to negative middle ear pressure commonly affecting bilaterally than unilateral. Total numbers of affected ear were 76 (82.61%).

Conclusion

Among the many childhood diseases, small percentage is diagnosed as having an enlarged adenoid with peak incidence between 6-10 years of age. Significant percentage has effect on middle ear pathology as OME, CSOM or permanent residual changes in the ear drum. In a few cases, orthodontic architectural deformity also develops resulting delayed speech development, impaired mental growth, physical and social complications. The morbidity can be prevented by primary health care education, early diagnosis and adequate treatment.

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Contribution of the Authors

The first author was responsible for conception, design, acquisition of data analysis and interpretation of data for research. The second one assisted in compiling data and finalized results, computer composing and printing.

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