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*Original Article*

## Pathophysiological Effect of Enlarged Adenoid on Middle Ear in Children

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**Abstract:**

**Objective:** To identify the incidence of otitis media with effusion (OME) in children with enlarged adenoid.

**Methodology:** This is a cross sectional observational study was carried out at Department of Otolaryngology and Head Neck surgery of Sir Salimullah Medical College Mitford Hospital, Dhaka from July 2014 to June 2016. One Hundred and Fifty (150) children with enlarged adenoid were included in this study. All patients were subjected for history, local physical examination, evaluation of adenoid size by X ray of nasopharynx lateral view. Pure tone audiometry & tympanometry were done in all patients. Informations were recorded in a specially designed data collection sheet.

**Result:** Among 150 children with enlarged adenoid 30(20%) patient had OME, majority of patients (60%) were age group 7-9 years. Male were predominant (60%) than female (40%). Among 150 patients grade- I was 16%, grade II- was 26%, grade-III was 54% and grade IV was 4%. According to the grading of enlarged adenoid cases, grade I, grade II, grade III and grade IV had 8.33%, 15.38%, 23.46% and 50% cases had OME respectively. Hearing loss was in 33(22%) children. According to tympanometry, type A curve was in 118(78.67%) children, type B 26(17.33%) and type C 6(4%) children.

**Conclusion:** Enlarged adenoid is associated with otitis media with effusion. Incidence of Otitis media with effusion increases with the proportion of severity of nasopharyngeal obstruction by enlarged adenoid.

**Key words:** Otitis media with effusion, adenoids, hearing loss.

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**Introduction:**

Lymphoid tissue in the submucosa of the roof of the nasopharynx called the pharyngeal tonsil. Excessive hypertrophy of this lymphoid tissue causes the pharyngeal tonsil to become enlarged; which is then commonly referred to as adenoids.<sup>1</sup> By the age of 5 months adenoid can be identified in all children. Growth continues rapidly during infancy and plateaus between 2 and 14 years of age in most children. Regression of adenoid occurs rapidly after 15 years of age in most children. Adenoid appears to be at its largest in the 7 years age group.<sup>2</sup>

The Adenoid Nasopharyngeal Ratio (ANR) is a more convenient radiologic parameter for determining whether adenoid hyperplasia is clinically significant or not, rather than the size of adenoid or the size of nasopharynx. ANR > 0.7 are considered to be the candidates for adenoidectomy.<sup>3</sup> In a study it shows that children with adenoid obstruction is 7 times more risk of developing OME than that of normal non-adenoidal children.<sup>4</sup>

The proportion of otitis media with effusion increases with the severity of nasopharyngeal obstruction by adenoid hypertrophy, and the most common type of tympanometry results seen among children with OME is type B. Grade III or more adenoid size of according to A/N ratio are mainly seen among patients having unilateral and bilateral OME, accounting for 16% and 37% of all cases with OME accordingly. In a study it was detected that 17.9% OME in children without complaints of hearing loss. Therefore, it is important to perform the middle ear examination and tympanometry in children before surgery even without parental suspicion of hearing loss.<sup>7</sup> In ears with documented fluid, the average hearing loss is 20 decibels (dB), but may be as high as 50 dB. OME is diagnosed by otoscopy, pneumatic otoscopy and tympanometry.<sup>8</sup>

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.<sup>7</sup>

**Objectives:**

a. General objective:

To evaluate the association of otitis media with effusion (OME) and adenoids in children.

b. Specific objectives:

1. To find out the prevalence of OME in children with adenoids
2. To find out degree of hearing loss in children with adenoids.
3. To determine the association between grade of adenoids to the development of OME.

**Materials and methods:**

Study design

Cross-sectional observational study

Place of the study

Department of Otolaryngology-Head and Neck Surgery, Sir Salimullah Medical College & Mitford Hospital, Dhaka.

Duration of the study

The study period was 24 months, from July 2014 to June 2016.

**Study population**

Children between 3-12 years old with enlarged adenoid attended to the department of Otolaryngology-Head and Neck Surgery, Sir Salimullah Medical College & Mitford Hospital, Dhaka.

**Sampling technique**

Purposive non randomized sampling method was used to select the sample. This purposive sampling was performed as per inclusion and exclusion criteria.

**Inclusion criteria**

Children of the age group of 3- 12 years with enlarged adenoid attending in Department of Otolaryngology-Head and Neck Surgery, SSMC Mitford Hospital.

**Exclusion criteria**

- Children with conductive hearing loss other than enlarged adenoid (CSOM, wax etc.).
- Parents or legal guardians not willing to be included for the study.
- Children with cleft palate and Down's syndrome
- Other causes of airway obstruction (deviated nasal septum, nasal polyposis, gross turbinate hypertrophy)

**Statistical Analysis**

Collected data were coded, processed and analyzed using computer software SPSS (Statistical Package for Social Sciences) version 20. The test statistics used for analysis of data were Z-test (for comparison of data presented in quantitative scale) and Chi-square Test (data presented in categorical scale). For any analytical test the level of significance was 0.05 and p-value < 0.05 was considered. The summarized data was interpreted accordingly and was then presented in the form of tables and graphs.

**Results:**

**Table-I: Age distribution of study subjects (N = 150)**

Age in years	Number of patients	Percentage of patients (%)
3 – 6	36	24
7 – 9	90	60
10 – 12	24	16

60% of patients were found in 7 – 9 years of age group.

**Table – II: Grading of adenoids (by radiography) (N = 150)**

Grade of adenoids	Number of patients	Percentage
Grade I	24	16
Grade II	39	26
Grade III	81	54
Grade IV	6	04

In this study, maximum 54% of cases had grade III adenoids.

**Table - III: Association between grade of adenoids and hearing status in children with adenoids**

Grades of adenoids	Intact hearing	Hearing loss (%)	Grand total
I	22	2(8.33)	24
II	32	7(17.95)	39
III	60	21(25.93)	81
IV	03	3(50)	06
Total	117	33	150

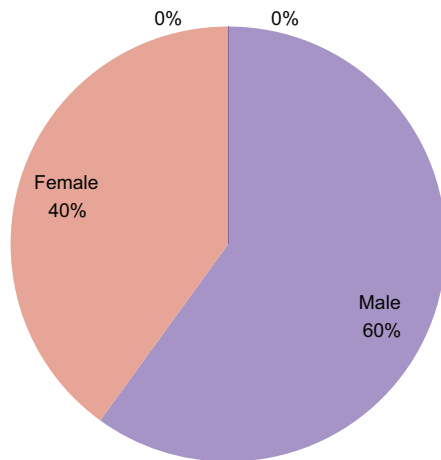
Table III shows out of 24 grade-I enlarged adenoid cases only 2 (8.33%) case had hearing loss, out of 39 grade-II enlarged adenoids cases 7(17.95%) cases had hearing loss, out of 81 grade-III enlarged adenoid cases 21(25.93%) cases had hearing loss and out of 6 grade IV enlarged adenoid cases 3(50%) cases had hearing loss. Chi-square ( $\chi^2$ ) value is 8.006 and P value is <0.05. So result is significant.

That means proportion of hearing loss increase with the severity of nasopharyngeal obstruction by adenoid hypertrophy.

**Table IV:** Type of the curve according to tympanometry (N=150)

Type of the curve	Number of patients (%)	No of ears
A	118 (78.67)	236
B	26 (17.33)	52
C	6 (4)	12
<b>Total</b>	150	300

Table IV shows type of the curve. Maximum 118(78.67%) patients had type A curve followed by 26(17.33%) and 6(4%) patients had type B and type C curve respectively.

**Fig.-1:** Sex distribution of OME patients (N = 30)

Male female ratio in OME patients was 1.5:1.

**Table – V:** Association between sizes of adenoids with frequency of OME (N = 150)

Grade of adenoids	Without OME	OME (%)	Total
Grade I	22	2(8.33)	24
Grade II	34	6(15.38)	39
Grade III	62	9(23.46)	71
Grade IV	3	13(50)	16
	120	30	150

Table V shows proportion of OME increase with the severity of nasopharyngeal obstruction by adenoid hypertrophy. Chi square ( $\chi^2$ ) value is 8.153 and P is < 0.05 which is statistically significant.

#### Discussion:

The prevalence of adenoids is common in age group of 3 to 7 years.<sup>9</sup> Because, in general, the normal adenoids attains their maximum size between the age of 3 and 7 years and then regress.<sup>10</sup> As nasopharyngeal space gradually increase in size, but on other hand adenoids regress after 7 years; so the important factor in considering the harmful effects of the adenoids is not the absolute size, but more the size in relation to that of the nasopharynx. In this study about 60% having adenoids in the age group of 7 to 9 years (table I). Enlarged adenoids among 60% patients in 5 to 6 years old group in a study which is not concordance with us.<sup>11</sup> Another study reported that large adenoids were most frequently observed between the ages of 6-8 years, this result is partially consistent with this study.<sup>10</sup>

Regarding degree of hearing loss 6 (4%) children had moderate (41 – 55 dB) and 27 (18%) children had mild hearing loss (26 – 40 dB) (table III). The hearing loss was mild in 50.5% and moderate in 12.7% children in a study<sup>5</sup>. Our results also shows mild hearing loss patients are more than moderate hearing loss which is consistent with this result but total percentage of hearing loss is less because of gradual awareness and healthcare facility.

In our study according to size of adenoids, maximum children (54%) had grade- III followed by grade- II (26%) (table III). In one study shows that maximum children (54.2%) had grade-III followed by grade-II (16.7%),

grade-IV (16.7%) and grade-I (12.5%).<sup>6</sup> Grade-I adenoids has only 2 (8.33%) hearing loss, grade-II 7 (17.95%), grade-III (25.93%) and grade IV 3 (50%) cases had hearing loss. Chi-square ( $\chi^2$ ) value is 8.006 and P value is  $<0.05$ . So result is significant. That means more the size of adenoids more the hearing loss..

Out of total 30 patients of OME with enlarged adenoids, there were 18 (60%) male and 12 (40%) female. The male-female ratio was 1.5:1 (figure I).

In our study, majority of tympanometry curve were type A (78.67%) followed by type B (17.33%) and type C (4%) in enlarged adenoid children (table IV). Our result is consistent with the result of Orji et al (2010), they found maximum type A (43.47%) followed by type B (34.78) and type C (21.73%).

In this study, myringotomy were done in 66 ears. Effusion was found in 60 (90.91%) ears of suspected effusion. Among the 66 ears with effusion at myringotomy the otoscopic diagnosis had been "Effusion" in 60 (90.91%) and suspected effusion in 6 (9.09%) ears (table VII). This study is consistent with J. L. Paradise *et al* study. In 6 cases, clinically it was suspected fluid in the middle ear but after myringotomy, the fluid could not be detected. The reason lies behind recent onset of Eustachian tube blockage with enlarged adenoids.

We have found 30 (20%) of patient had OME due to adenoids which is consistent with another study ; where he showed 17.9% of the ears with OME due to adenoid hypertrophy were confirmed by myringotomy.<sup>7</sup>

Our study showed a positive association between the degree of nasopharyngeal obstruction and the presence of OME. It was also found that there was an increase in the

incidence of OME with the increase in the size of adenoids, as 50% with grade IV adenoids, 23.46% with grade III adenoids and 15.38% of grade II adenoids patients suffered from OME. Children with larger adenoids (grade IV) had more than four and two times the risk of developing OME than children with grade II and grade III nasopharyngeal obstruction respectively.

### Conclusion:

Enlarged adenoid is associated with otitis media with effusion (OME) in children. The larger the size of adenoids greater the degree of hearing loss. Increase severity of nasopharyngeal obstruction is directly associated with increased rate of OME.

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