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The ear-adenoid nexus: Unraveling the impact of adenoid hypertrophy size on asymptomatic otitis media effusion

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Abstract

Introduction: Adenoid hypertrophy may lead to a condition called Otitis Media with Effusion (OME). However, hearing loss caused by OME is frequently overlooked and remains asymptomatic in children. This oversight can have adverse effects on cognitive development and academic performance.

Aim: To estimate the frequency of asymptomatic OME in children with adenoid hypertrophy and to find the association between adenoid size and occurrence of OME.

Materials and Methods: This cross-sectional observational study was conducted at a tertiary care center in Mirzapur, Tangail, Bangladesh, with 124 patients spanning from April 2023 to September 2023. The study focused on children aged 5 to 12 who displayed adenoid hypertrophy symptoms but had not reported any hearing issues. It involved a thorough clinical examination of the ear, nose, and throat. Additionally, all patients underwent tympanometry. Adenoid size was assessed by using nasal endoscopy and radiographs using Mc Murray and Clements scale. The prevalence of OME was expressed as a percentage, and Fisher's exact test was utilized to analyze the relationship between adenoid size and the presence of asymptomatic OME.

R**esults:** Data from 154 cases of adenoid hypertrophy were analyzed. The commonest age of presentation was 5-8 years (66.9%). Otoscopy found that 71 individuals (equivalent to 56.26%) had a normal tympanic membrane on both sides. And the majority (13.7%) had bilateral air-fluid levels. 67.7% of participants with adenoid hypertrophy had no effusion, and 32.3% had otitis media with effusion. This connection between endoscopic and radiological adenoid size and OME was statistically significant, with a p-value of less than 0.05. Impedance audiometry showed that most candidates (52.8%) presented with a 'B' type tympanogram. That indicates many participants with OME were not identified clinically but diagnosed by impedance audiometry.

Conclusion: There was an association between adenoid size and the occurrence of OME. Among the study participants, approximately 32.3% were clinically identified as having asymptomatic OME.

Keywords: Adenoid hypertrophy; Otitis Media with Effusion; OME; Asymptomatic Otitis Media Effusion; Asymptomatic OME

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1. Introduction

Otitis media with effusion (OME) is characterized by non-purulent secretions, which may be serous or mucous, in the middle ear, and it typically lacks the signs or symptoms associated with an acute ear infection. If left unaddressed, this condition can lead to hearing impairment and persistent consequences, including adverse effects on speech development and behavior. OME is an exceedingly prevalent condition, affecting approximately 90% of children (80% of individual ears) at some point before they enter school, typically occurring between the ages of 6 months and 4 years. While many OME episodes resolve spontaneously within 3 months, a substantial proportion, ranging from 30% to 40% of children, experience recurrent OME, and a smaller percentage, from 5% to 10%, endure episodes lasting one year or longer [1].

Examination of the tympanic membrane can contribute to the clinical identification of (OME), and using audiometer platforms based on pure-tone and impedance measurements allows for the objective assessment of auditory levels. The Type-B tympanogram is a highly dependable, non-invasive analytical instrument for diagnosing OME [2].

Adenoid hypertrophy (AH) is a common health issue in young children. Adenoids are a part of Waldeyer's ring, and due to their anatomical location, they can play a significant role in the development of otitis media when they become inflamed or enlarged [3]. There is a strong association between middle-ear problems and AH, although the exact mechanisms behind this connection remain unclear. AH has the potential to physically obstruct the eustachian tube, which serves as the anatomical pathway for ventilation. When this tube becomes blocked, it can lead to negative pressure within the middle ear, ultimately contributing to developing clinical conditions [4][5].

A study has shown significant associations between the size of adenoids and the viscosity of middle-ear effusion, irrespective of the nature of clinical symptoms and the time frame of their occurrence [6]. Asymptomatic OME can be challenging to diagnose, as it often goes unnoticed by parents and caregivers. However, diagnosing and treating asymptomatic OME is essential, as it can lead to hearing loss and other complications if left untreated [7].

This study investigates the impact of adenoid hypertrophy size on asymptomatic OME. The findings will help to improve our understanding of the relationship between AH and OME. They could lead to the development of more effective strategies for the diagnosis and management of asymptomatic OME.

2. Material and methods

This cross-sectional observational study was conducted at a tertiary care center in Mirzapur, Tangail, Bangladesh, spanning from April 2023 to September 2023. Written consent was obtained from the parents. The study involved 124 children ranging from 5 to 12 years.

2.1. Inclusion Criteria

Participants included children with adenoid hypertrophy whose parents did not suspect hearing loss and who had intact tympanic membranes. Adenoid hypertrophy was confirmed by nasoendoscopic examination and radiological investigations.

2.2. Exclusion Criteria

Children meeting any of the following criteria were not included in the study: Complaints of hearing loss, recent acute infections, prior ear surgery that included the insertion of ventilation tubes, cleft palate, Down syndrome, congenital ear malformations, cholesteatoma or chronic mastoiditis, acute or chronic widespread external otitis, tympanic membrane perforation, or if their records were incomplete.

The evaluation consisted of a thorough medical history, ear, nose, and throat examination, otoscopic examination, nasoendoscopy, radiological investigations, and tympanometry. During the history-taking, children's complaints related to nasal obstruction, snoring, mouth breathing, and sleep-related breathing difficulties were inquired about. Additionally, parents were questioned about their suspicions of hearing loss.

In all instances, a lateral view X-ray of the soft tissue in the nasopharynx was conducted to evaluate the size of the adenoids. This involved measuring the distance between the maximum convexity of the adenoid and a line drawn along the basiocciput (referred to as "A") and the distance between the posterior superior edge of the hard palate and

anteroinferior edge of sphenobasioccipital synchondrosis (referred to as "N"). Subsequently, an A/N ratio was computed and categorized into grades [8][9].

Grades are-

Grade 0- (0.0-0.25): No adenoid enlargement
Grade I- (0.26-0.50): minimal
Grade II- (0.51-0.75): moderate
Grade III- (0.76-1.00): gross enlargement

Endoscopic nasal examinations were conducted for all patients, and images from these examinations were analyzed to determine the ratio of adenoid tissue obstruction to the choanal opening using a 0-degree 2.7 or 4 mm rigid nasal endoscope. The degree of obstruction by the adenoid tissue over the posterior choana was estimated using the grading system proposed by McMurray and Clements [10].

Grade I- Adenoid tissue filling 1/3rd of the vertical height of choana.
Grade II- Adenoid tissue filling 2/3rd of the vertical height of choana.
Grade III- From 2/3rd to nearly all but not completely filling the choana.
Grade IV- Complete choanal obstruction.

Tympanometry was carried out by an audiologist using an impedance. The tympanograms were categorized using a modified Jerger's classification into types A, B, or C [11].

The link between the size of adenoids and the incidence of OME (Otitis Media with Effusion) was examined through Fisher's exact test. A p-value below 0.05 was considered to indicate statistical significance. The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 26 software

3. Results

Data from 154 cases of adenoid hypertrophy were analyzed, and the results were tabulated. Age of the participants ranged from 5 to 12 years. The commonest age of presentation was 5-8 years (83 patients, 66.9%). [Table 1]

Table 1 Patient Distribution According To Age

Age Range	Number of Patients	Percentage
5-8 years	83	66.9%
8-12 years	41	33.1%
Total	124	100.0%

Sex distribution among our participants revealed that 70 patients (56.5%) were males, and 54 patients (43.5%) were females. [Figure 1]

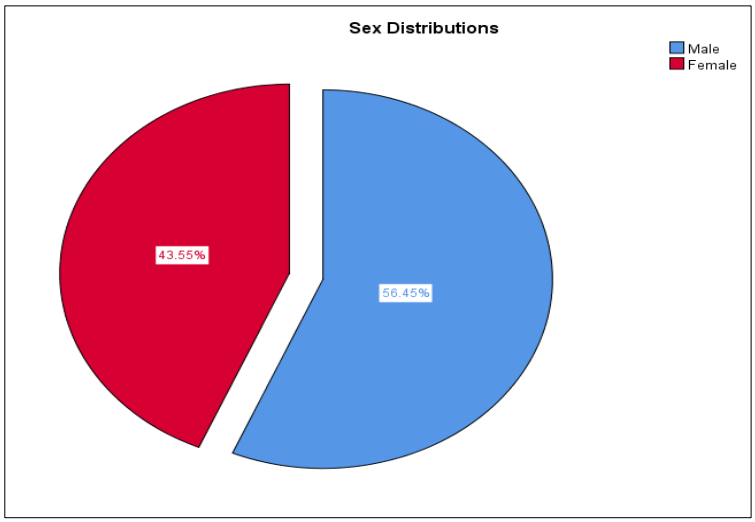

Figure 1 Patient distribution According to Gender

On evaluating the symptoms of the participants, the majority of the patients in this study suffered from snoring (37.1%). Other common symptoms are mouth breathing (28.2%), sleep disturbance (11.3%) and Nasal obstruction (23.4%) **[Table 2]**

Table 2 Symptom distribution of participants

Symptoms	Number of Patients	Percentage
Snoring	46	37.1%
Mouth breathing	35	28.2%
Sleep disturbance	14	11.3%
Nasal obstruction	29	23.4%
Total	124	100.0%

When otoscopy done for observing the tympanic membrane, found that 71 individuals (equivalent to 56.26%) had a normal tympanic membrane on both sides, 15 individuals (12.1%) exhibited unilateral retracted tympanic membranes, 7 individuals (5.65%) exhibited bilateral retracted tympanic membranes, 14 individuals (11.3%) had unilateral air-fluid levels and 17 individuals (13.7%) had bilateral air-fluid levels. **[Figure 2]**

When evaluating adenoid size through nasal endoscopy, the findings revealed that the majority (48.4%) exhibited grade I adenoid hypertrophy, 37.9% showed grade II hypertrophy, and the remaining (13.7%) children had grade III hypertrophy. Out of those with grade I adenoid hypertrophy, 15.8% had bilateral effusion, and 4.8% had unilateral effusion. Whereas among those with grade II hypertrophy, 47.4% had bilateral effusion, and 66.7% had unilateral effusion. Regarding grade III hypertrophy, 36.8% had bilateral effusion, and 28.6% had unilateral effusion.

In total, 67.7% of participants with adenoid hypertrophy had no effusion, and 32.3% of participants with adenoid hypertrophy had otitis media with effusion. This connection between endoscopic adenoid size and otitis media with effusion was statistically significant, with a p-value of less than 0.05. **[Table 3]**

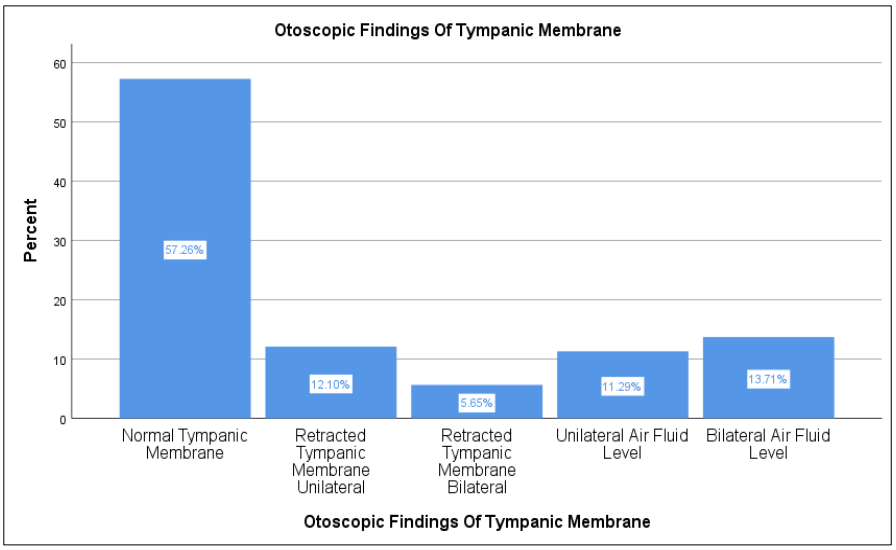

Figure 2 Otoscopic findings of participants

Table 3 Association between otitis media with effusion and endoscopic adenoid size

Adenoid size	Effusion			Total N (%)	p-value (Fisher's exact test)
	Unilateral n (%)	Bilateral n (%)	No Effusion		
Grade 0	0 (0%)	0 (0%)	0 (0%)	0 (0%)	<0.05
Grade I	1 (4.8%)	3 (15.8%)	56 (66.7%)	60 (48.4%)	
Grade II	14 (66.7%)	9 (47.4%)	24 (28.6%)	47 (37.9%)	
Grade III	6 (28.6%)	7 (36.8%)	4 (4.8%)	17 (13.7%)	
Total	21	19	84	124	

When assessing adenoid size through radiographic means, the findings revealed that the majority (49.2%) exhibited grade II adenoid hypertrophy, 37.9% showed grade III hypertrophy, and the remaining (12.9%) children had grade IV hypertrophy. Out of those with grade II adenoid hypertrophy, 15.8% had bilateral effusion, and 4.8% had unilateral effusion. Whereas among those with grade III hypertrophy, 52.6% had bilateral effusion, and 66.7% had unilateral effusion. In the case of grade IV hypertrophy, 31.6% had bilateral effusion, and 28.6% had unilateral effusion.

In total, 67.7% of participants with adenoid hypertrophy had no effusion, and 32.3% had otitis media with effusion. This connection between endoscopic adenoid size and otitis media with effusion was found to be statistically significant, with a p-value of less than 0.05 **[Table 4]**

Table 4 Association between otitis media with effusion and radiographic adenoid size

Adenoid size	Effusion			Total N (%)	p-value (Fisher's exact test)
	Unilateral n (%)	Bilateral n (%)	No Effusion		
Grade I	0 (0%)	0 (0%)	0 (0%)	0 (0%)	<0.05
Grade II	1 (4.8%)	3 (15.8%)	57 (67.9%)	61 (49.2%)	
Grade III	14 (66.7%)	10 (52.6%)	23 (27.4%)	47 (37.9%)	
Grade IV	6 (28.6%)	6 (31.6%)	4 (4.8%)	16 (12.9%)	
Total	21	19	84	124 (100%)	

The distribution of tympanogram findings of participants (total 248 ears) is represented in Table 5 below. Impedance audiometry showed that most candidates (52.8%) presented with a 'B' type tympanogram. This suggested that a total of 52.8% of the study population had fluid in the middle ear, which was greater than the percentage of clinically diagnosed OME. That indicates a large number of participants with OME not identified clinically but diagnosed by impedance audiometry.

Table 5 Tympanogram findings of participants (n=248)

Types Of Tympanogram			**Total N (%)**
	Right Ear n (%)	Left Ear n (%)	
Type A	47 (37.9%)	54 (43.5%)	101 (40.7%)
Type B	71 (57.3%)	60 (48.4%)	131(52.8%)
Type C	6 (4.8%)	10 (8.1%)	16 (6.4%)

4. Discussion

Otitis Media with Effusion (OME) is the accumulation of serous fluid in the middle ear. It becomes a chronic condition when OME persists for three months or longer. Typically, OME is triggered by factors such as viral upper respiratory tract infections, secondary bacterial infections, and nasal allergies, which release various inflammatory mediators [12]. Since adenoid hypertrophy primarily affects children, the absence of awareness and delayed communication with parents or guardians regarding symptoms can lead to hearing problems, resulting in adverse social behavior and delayed speech and language development in children [13]. If OME occurs in infants under four, it can affect auditory sensitivity [14]. Any disruption in auditory input during the critical developmental period of central auditory system plasticity in childhood can lead to impaired auditory cortex development and other developmental irregularities [15]. This study aimed to determine whether otitis media is prevalent within adenoid hypertrophy diagnosed children.

This prospective study selected 154 children between 5-12 years with adenoid hypertrophy. Where the age group of 5-8 years was predominant. The study revealed an increase in the incidence of OME in males (56.5%) compared to females (43.5%). This was nearly the same as found by Ali et al. [16].

The majority of the patients presented with more than one symptom. The common symptom of the patients of adenoids was snoring (37.1%). Other common symptoms were mouth breathing (28.2%), sleep disturbance (11.3%) and Nasal obstruction (23.4%) **[Table 2]**

Otoscopy done for observing the tympanic membrane found that 71 individuals (equivalent to 56.26%) had a normal tympanic membrane on both sides, 15 individuals (12.1%) exhibited unilateral retracted tympanic membranes, 7 individuals (5.65%) exhibited bilateral retracted tympanic membranes, 14 individuals (11.3%) had unilateral air-fluid levels and 17 individuals (13.7%) had bilateral air-fluid levels. **[Figure 2]**

This study graded adenoid size based on radiological and endoscopic findings and showed a significant association between OME and adenoid size. Children with higher grades of adenoids detected radiologically and endoscopically showed greater bilateral middle ear effusions than those with lower grades, similar to the study conducted by Skoloudik et al. [1].

Impedance audiometry showed that most candidates (52.8%) presented with a 'B' type tympanogram. This suggested that a total of 52.8% of the study population had fluid in the middle ear, which was greater than the percentage of clinically diagnosed OME. That indicates a large number of participants with OME not identified clinically but diagnosed by impedance audiometry. **[Table 5]**

In our study, about 32.3% were found to have asymptomatic OME. These results were comparable to the study conducted by Bhat et al. in 100 children, in which 36% had asymptomatic OME [17]. Casselbrant et al. also found that most children were unrecognized until parents noticed a delay in speech development, poor performance in school, or hearing loss [18].

So, detecting OME at an early stage is crucial. The findings of this study strongly emphasize the necessity of assessing OME in children with adenoid hypertrophy because a substantial number of cases had undetected OME. Ignoring this condition may result in harmful consequences for their social and cognitive development in the future.

5. Conclusion

This study revealed a correlation between the size of adenoids and the likelihood of OME. Tympanometry, a non-invasive method for OME diagnosis, should be implemented as a standard screening procedure for all children with adenoid hypertrophy. This approach is essential in order to prevent notable delays in language and speech development.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declared no conflict of interest.

Statement of ethical approval

Proper ethical approval was taken.

Statement of informed consent

Written consent was obtained from the parents.

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