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Original Article

Role of Adenoids in Children with Retracted Ear Drum

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Abstract

Introduction: Adenoid enlargement has traditionally been considered a factor in otitis media with effusion (OME). It is one of the common health problems seen in children and, when inadequately treated or left untreated, it may lead to sequelae and complications. Negative middle ear pressure is also an important and common condition in pediatric age group that can result from adenoid hypertrophy (AH). Since AH produces ear block in children, the study is formulated to estimate the level of its effects in such individuals.

Purpose of the Study: Although some literature associates enlarged adenoid with OME and negative middle ear pressure, there are some studies questioning this relationship. The purpose of this study is to find the association between AH in children and negative middle ear pressure.

Materials and Methods: This study was performed in children from 5 years of age up to 13 years of age attending our outpatient department. Around 593 children who attended the outpatient department for (clinical complaints) were screened for AH and negative middle ear pressure-type c-curve. AH was assessed by X-ray nasopharynx and negative middle ear pressure by impedance audiometry.

Results: A total of 70 patients complied with the study protocol. 10 candidates did not report after the pre-operative assessment (n = 70). A significant correlation between AH and negative middle ear pressure was obtained with a value of 0.001 which indicated that higher the level of AH lower is the middle ear pressure level.

Conclusion: We conclude that AH has a significant effect on middle ear pressure causing negative pressure in the middle ear in children. The occurrence of bilateral negative middle ear pressure is a more reliable indicator that AH is the cause than unilaterally occurring negative middle ear pressure.

Key words: Adenoids, Middle ear pressure, Otorhinolaryngology, Tympanometry, X-ray

INTRODUCTION

Santorini described the nasopharyngeal lymphoid aggregate as Luschka's tonsil in 1724. Wilhelm Meyer coined the term "Adenoid" to describe what he described as "nasopharyngeal vegetations" in 1870. Adenoid hypertrophy (AH) is common in occurrence in the pediatric age group. It has been associated with negative middle ear pressure by displacement of the Eustachian tube orifice and its obstruction. In addition, some consider that together with the tonsils, the adenoids constitute reservoir of infection. In children, the adenoids are invariably enlarged and there is little evidence to suggest that large adenoids are more frequently associated with otitis media with effusion (OME) than with normal ears.[1,2]

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The size of adenoids varies from child to child and also in the same individual as the child grows. In general, it attains maximum size between the ages of 3 and 7 years and then regresses.[3] However, there is a significant growth of the soft tissue of the nasopharynx between the age of 3 and the age of 5 years, which leads to the narrowing of

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the nasopharyngeal airway[4] Subsequently, the growth of the nasopharynx increases while the soft tissues remain relatively unchanged, and thus, the airway increases.[5]

Although some literature associates enlarged adenoid with OME and negative middle ear pressure, there are some studies questioning this relationship.[6-8] Although there are a large number of prevalence studies of OME in general population of children, there has been less research on its prevalence in children having adenoidal obstruction and its association with negative middle ear pressure.[9]

The vast majority of both clinical and basic studies on middle ear pressure have been based on measurements by tympanometry. Since AH produces ear block in children, the study is formulated to estimate the level of its effects on middle ear pressure using tympanometry in such individuals.

MATERIALS AND METHODS

This prospective randomized comparative study was conducted from August 2014 to June 2016 in the Department of Otorhinolaryngology at Saveetha Medical College and Hospitals. This study was performed in children from 5 years of age up to 13 years of age attending our outpatient department. Around 593 children, who attended, the outpatient department for (clinical complaints) were screened for AH and negative middle ear pressure-type c-curve. AH was assessed by X-ray nasopharynx and negative middle ear pressure by impedance audiometry. The study was approved by institutional review board, and the Institutional Ethics Committee held at our college which was conducted in accordance with ethical standards established by declaration of Helsinki (2000). 80 candidates were positive around which 10 candidates did not give consent for the study. An informed consent was taken from the parents of the candidates.

The patients with AH with relevant radiological correlation with X-ray nasopharynx, patients with negative middle ear pressure recorded by impedance audiometry as type c-curve and patients above 5 years of age and below 13 years of age were included in the study.

All children >13 years of age (or) <5 years of age, with cleft palate (or) submucosal cleft palate, coagulation disorders, sinonasal polyposis, choanal atresia, tumors of nose and nasopharynx, thornwaldt's cyst, cervical instability (e.g.) Down syndrome, with tympanic membrane perforation in one or both ears, without relevant X-ray findings, with secretory otitis media, acute otitis media, chronic otitis media, congenital malformations in the ear such as microtia, congenital atresia, with primary ciliary dyskinesia, children whose parents or caregivers who declined to give consent and children presenting with other comorbidities (e.g.: Cor pulmonale, renal disease, neurological disease, and malnutrition) were excluded from the study.

The patient's data included age, sex, and presenting symptoms (recurrent upper respiratory tract infection (URI); sore throat; fever; nose block; snoring and/or mouth breathing); all the patients underwent ear, nose, and throat examination, including otoscopic examination. If present the wax was carefully removed.

Suspecting negative middle-pressure subjects underwent impedance audiometry test. The impedance audiogram was performed by the audiologist in our institution. The readings were classified as Type A (400 and + 200 daPa) with Score 3, Type B (no pressure peak) with Score 2, and Type C (−400 daPa and 0 daPa) Score 1. Further investigation was performed, which included X-rays of nasopharynx to assess adenoid size. AH was recorded as per the radiological grading which was based on the study done by Ehab *et al.*[10] such as the AH was considered small if it causes 25% obliteration of nasopharynx and was categorized as Grade 1 and was scored as 1, the AH was considered moderate if it causes 50% obliteration of nasopharynx and was categorized as Grade 2 and was scored as 2, and the AH was considered large if it causes 75% and more obliteration of nasopharynx and was categorized as Grade 3 and was scored as 3 (Tables 1 and 2).

Based on the prevalence study conducted by Chinawa *et al.*[11] and Santos *et al.*,[12] we arrived at our sample size. Simple random sampling was done for all patients with AH with relevant radiological correlation with X-ray nasopharynx having negative middle ear pressure recorded by impedance audiometry as type C-curve and those who were above 5 years of age and below 13 years of age.

Data recorded in the preformatted data sheets were analyzed using the statistical product and service solutions (SPSS) 22. Means and percentages were calculated. Pearson correlation method was used to calculate the statistical significance of AH with relation to negative middle ear pressure. Data representation done in the form of tables and respective graphs. A statistical value for probability of error, i.e., a $P < 0.05$ was considered significant.

RESULTS

A total of 80 patients enrolled for the study. Since the study was a pre-operative and post-operative comparative study,

the subjects themselves were controls ($n = 80$). All patients underwent X-ray nasopharynx and impedance audiometry. 70 patients complied with the study protocol. 10 candidates did not report after the pre-operative assessment ($n = 70$) .

Among the 70 patients, 37 patients were males and 33 patients were females. The average male percentage in the group was 52.9% and female percentage of the group was found to be 47.1%. This gave a male to female sex ratio of 0.53:0.48, respectively (Figure 1).

	Frequency (%)
Male	37 (52.9)
Female	33 (47.1)
Total	70 (100.0)

Among the given sample 27 patients had of sore throat with an average of 38.6%, 22 patients had nose block with an average of 31.4%, 11 patients were given a history of snoring by the parents with an average of 15.7%, 5 patients had mouth breathing with an average of 7.1%, 3 patients had fever with an average of 4.3%, and 2 patients had recurrent URIs with an average of 2.9%, respectively (Table 3 and Figure 2).

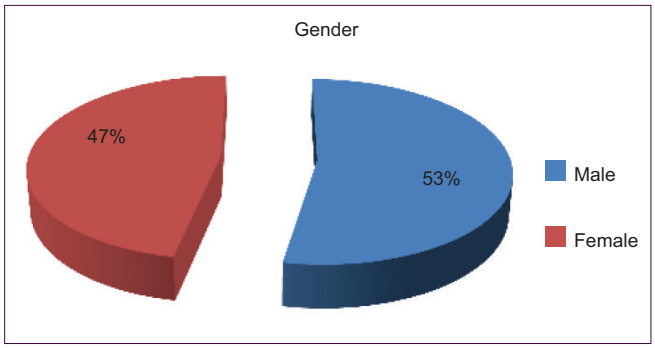

Figure 1: Male percentage and female percentage

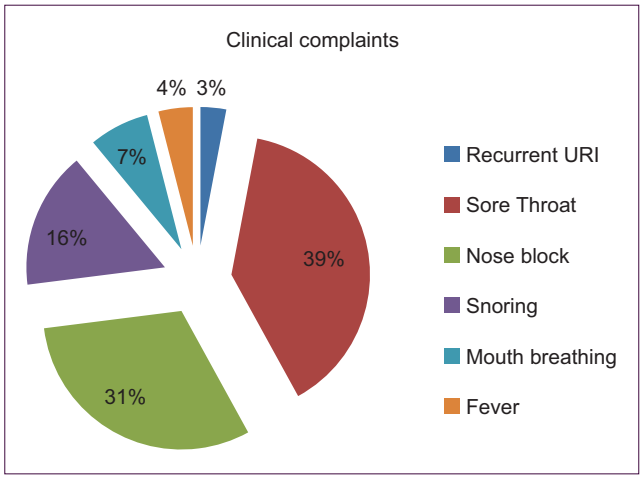

Figure 2: Percentage of clinical complaints

Around 33 patients were found to have Grade 3 AH, 28 patients were found to have Grade 2 AH and 9 patients were found to have Grade 1 AH, with an average percentage of 47.14% for Grade 3 AH, 40% showed Grade 2 AH, and 12.86% showing Grade 3 AH (Figure 3).

About 28 patients had Type C impedance audiograms in both ears with an average of 40%, whereas 42 patients had unilateral Type C impedance audiometry with an average of 60% in single ear alone.

Nearly 9 patients had Grade 1 tonsillar hypertrophy, 25 patients presented with Grade 2 tonsillar hypertrophy, 28 patients had Grade 3 tonsillar hypertrophy, and 8 patients had Grade 4 tonsil hypertrophy. Figure 4 shows the percentage of the various grades of tonsil hypertrophy.

About 65 patients were found to have congested nasal mucosa and 5 patients were found to have normal nasal mucosa. Pearson correlation method was used to determine the association between AH and negative middle ear pressure. The significance level was 0.01 obtained by negative coefficient parameters, which showed that greater the AH lesser is the middle ear pressure (Table 4).

DISCUSSION

In this study, it is found that AH significantly causes negative middle ear pressure leading to retracted ear drum in children. In Gunel *et al.*'s[8] study, AH was associated

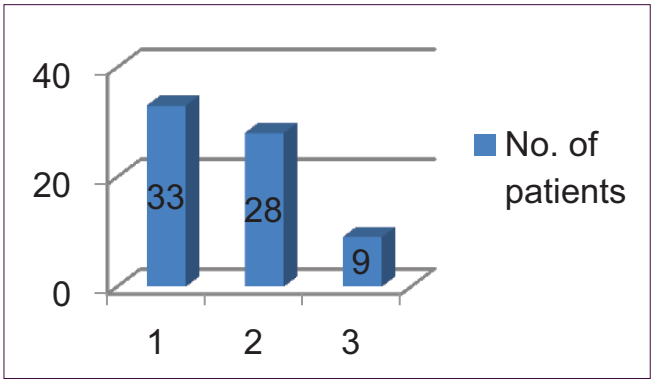

Figure 3: Number of patients in each grade of hypertrophy

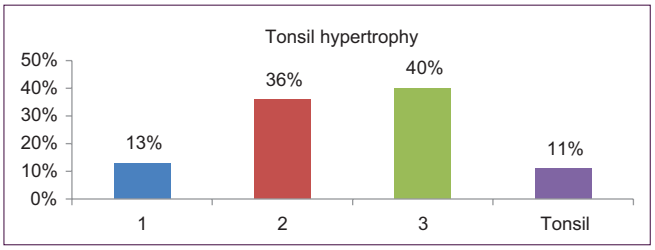

Figure 4: Percentage of tonsil hypertrophy

with increased negative pressure in the middle ear. Enlarged adenoids lead to Eustachian tube displacement or obstruction.

AH causes negative middle ear pressures by Type C impedance audiometry than Type B. Nwosu *et al.*[7] stated that the incidence of OME among patients with AH was 55.9% in this study with more Type B (29.4%) than Type C (26.5%). When compared with control, there was about a 4-fold increase in the incidence of OME. This establishes the significance of AH as a risk factor in the pathogenesis of OME.

Retracted tympanic membrane was more commonly associated with AH in our collected data. Satish *et al.*[13] found that on otoscopy, dull, and amber-colored tympanic membrane was the common finding seen in 94% of cases. Retraction of tympanic membrane was seen in 64%. Air bubbles were seen only in 16%. According to their studies, negative middle ear pressure was more common than ears with OME.

Orji *et al.* showed from their prospective clinical study, 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. It was concluded that adenoid obstruction is a significant risk factor for negative middle ear pressure in children which in turn increases with the increasing degree of nasopharyngeal obstruction.[14]

Adenoid enlargement is negatively related to middle ear pressure according to our study, implying that the larger, the adenoid mass that obliterates the airway in the nasopharynx lower is the middle ear pressure. Pan *et al.*[15] found that the middle ear pressures were negatively related to the adenoidal nasopharyngeal ratio ($r = 0.41$, $P < 0.05$). The Eustachian tube function of the children with AH was worse than the normal.

Wormald *et al.* reported that, in doubtful cases, nasal endoscopy under local anesthesia provides a definitive evaluation of the nasal cavity and nasopharynx state. Difficulties involved in submitting noncollaborative young children to endoscopy are a disadvantageous feature of this procedure.[16]

Linder-Aronson *et al.* stated that lateral radiographs provide a simple method of assessing the outline of nasopharynx and the soft tissue in relation to airway.[17] Kurien *et al.* stated that lateral X-rays of the neck, besides being a noninvasive procedure, still remains a very reliable and valid diagnostic test in the evaluation of hypertrophied adenoids.[18] Hence, the measurement of AH can be done adequately with X-ray nasopharynx, and the corresponding variations in middle ear pressure can be elucidated with impedance audiometry.

Table 1: Grade of adenoid hypertrophy

Grade of adenoid hypertrophy	Radiological percentage of obliteration of nasopharynx	Score
1	25%	1
2	50%	2
3	75% and above	3

Table 2: Impedance values

Pre-operative impedance audiometry
Type A
Type B
Type C

Table 3: Clinical complaints occurrence and percentage

Complaints	Frequency (%)
Recurrent URI	2 (2.9)
Sore throat	27 (38.6)
Nose block	22 (31.4)
Snoring	11 (15.7)
Mouth breathing	5 (7.) 1
Fever	3 (4.3)
Total	70 (100.0)

URI: Upper respiratory tract infection

Table 4: Pearson correlation

Correlations	X-ray pre-operative	Imp pre-operative
X-ray nasopharynx		
Pearson correlation	1	−0.772**
Sig. (2-tailed)		0.000
N	70	70
Impedance		
Pearson correlation	−0.772**	1
Sig. (2-tailed)	0.000	
N	70	70

**Correlation is significant at the 0.01 level (2-tailed)

CONCLUSION

AH has a significant effect on middle ear pressure causing negative pressure in the middle ear. Impedance audiometry is the standard diagnostic tool available for measuring middle ear pressures and functional status. The occurrence of bilateral negative middle ear pressure is a more reliable indicator that AH is the cause than unilaterally occurring negative middle ear pressure. Gender, duration of symptoms, and symptomatology are not significant risk

factors for negative middle ear pressure in children with obstructive adenoid disease. Children with negative middle ear pressure may not present with a history of hearing loss. When comparing children with moderate to gross adenoid enlargement of adenoid tissue, the relative size of adenoid to that of nasopharynx does not increase the risk of developing OME significantly but causes changes in middle ear pressure. Hence, children with features of obstructive adenoid disease should be carefully examined for the possible existence of negative middle ear pressure. The role of adenoid enlargement in the pathogenesis of negative middle ear pressure can be determined by conducting further studies on adenoid enlargement and its effect on middle ear pressure.

REFERENCES

1. Browning LL. Aetiopathology of inflammatory condition of external and middle ear. Scott-Browns Otolaryngology. Vol. 3. London: Arnold; 2008. p. 12-14.
2. Sadler TW, editor. Langman's Medical Embryology. Baltimore, Maryland, USA: Willams and Wilkins; 1995. p. 347354.
3. Jalisi M, Jazbi B. Chronic middle ear effusion. Current problems in otorhinolaryngology. Pakistan: Pakistan Doctors Publication; 1991. p. 85-97.
4. Acharya K, Bhusal CL, Guragain RP. Endoscopic grading of adenoid in otitis media with effusion. JNMJ Nepal Med Assoc 2010;49:47-51.
5. Jeans WD, Fernando DC, Maw AR, Leighton BC. A longitudinal study of the growth of the nasopharynx and its contents in normal children. Br J Radiol 1981;54:117-21.
6. Al-Juboori AN, Al-Aqeedee AA, Saeed HD. Otitis media with effusion in children: A follow up study in West Baghdad, Iraq. J Commun Disord Deaf Stud Hear Aids 2014;2:122. doi: 10.4172/2375-4427.1000122.
7. Nwosu C, Uju Ibekwe M, Obukowho Onotai L. Tympanometric findings among children with adenoid hypertrophy in Port Harcourt, Nigeria. Int J Otolaryngol 2016;2016:1276543.
8. Günel C, Ermisler B, Basak HS. The effect of adenoid hypertrophy on tympanometric findings in children without hearing loss. Kulak Burun Bogaz Ihtis Derg 2014;24:334-8.
9. Souza BB, Hennemann GV, Anselmo-Lima WT. Importance of nasal fiberoptic examination in the presence of a normal X-ray of the cavum. Int J Pediatr Otorhinolaryngol 2000;55:29-32.
10. Ehab TY, Ammar HK, Falih A. Adenoid enlargement assessment by plain X-ray and nasoendoscopy. Iraqi J Community Med 2012;1:88-91.
11. Chinawa JM, Akpeh JO, Chinawa AT. Clinical profile and pattern of adenoid hypertrophy among children attending a private hospital in Enugu, South East Nigeria. Pan Afr Med J 1937;21:191.
12. Santos RS, Cipolotti R, DÁvila JS, Gurgel RQ. School children submitted to nasal fiber optic examination at school: findings and tolerance. J Pediatr (Rio J) 2005;81:443-6.
13. An AK. A Study on Role of Adenoidectomy in Otitis Media with Effusion (Doctoral Dissertation, Rajiv Gandhi University of Health Sciences).
14. Orji FT, Okolugbo NE, Ezeanolue BC. The role of adenoidal obstruction in the pathogenesis of otitis media with effusion in Nigerian children. Niger J Med 2010;19:62-8.
15. Pan H, Li L, Liang Z, Xian Z. Relationship between adenoids hypertrophy and tympanogram/eustachian tube function in children. Lin Chuang Er Bi Yan Hou Ke Za Zhi 2005;19:1015-6.
16. Wormald PJ, Prescott CA. Adenoids: Comparison of radiological assessment methods with clinical and endoscopic findings. J Laryngol Otol 1992;106:342-34.
17. Linder-Aronson S, Henrikson CO. Radiocephalometric analysis of anteroposterior nasopharyngeal dimension in 6 to 12 years old mouth breathers compared with nose breathers. ORL J Otorhinolaryngol Relat Spec 1973;35:19-29.
18. Kurien M, Lepcha A, Mathew J, Ali A, Jeyaseelan L. X-rays in the evaluation of adenoid hypertrophy: It's role in the endoscopic era. Indian J Otolaryngol Head Neck Surg 2005;57:45-7.

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