

Original Research Article

EFFECT OF ADENOTONSILLECTOMY ON OTITIS MEDIA WITH EFFUSION

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ABSTRACT

Background: Otitis media with effusion (OME) is one of the most common causes of hearing impairment in children and is characterized by the presence of fluid in the middle ear without signs of acute infection. Adenoid hypertrophy and chronic adenotonsillar enlargement are recognized contributors to Eustachian tube dysfunction, resulting in persistent middle ear effusion. Adenotonsillectomy is frequently performed in children with adenotonsillar hypertrophy and may play a significant role in improving middle ear ventilation and resolving OME. **Aim:** To evaluate the effect of adenotonsillectomy on otitis media with effusion in pediatric patients.

Materials and Methods: A prospective interventional study was conducted in the Department of Otorhinolaryngology of a tertiary care teaching hospital over a period of 14 months. A total of 120 children aged 3–15 years diagnosed with otitis media with effusion and adenotonsillar hypertrophy were included. Detailed clinical examination, otoscopic assessment, pure tone audiometry, and tympanometry were performed preoperatively. All patients underwent adenotonsillectomy and were followed up for three months postoperatively. Changes in middle ear status, hearing thresholds, tympanometric findings, and associated symptoms were analyzed.

Results: The majority of patients belonged to the 5–10-year age group, with a slight male predominance. Bilateral OME was observed in most patients. Hearing impairment, mouth breathing, snoring, and nasal obstruction were common presenting symptoms. Preoperatively, Type B tympanogram was the predominant finding. Following adenotonsillectomy, significant improvement was observed in tympanometric patterns and hearing thresholds. Complete resolution of middle ear effusion was achieved in the majority of patients at three months of follow-up. Significant improvement was also noted in associated upper airway obstructive symptoms.

Conclusion: Adenotonsillectomy is an effective surgical intervention for children with otitis media with effusion associated with adenotonsillar hypertrophy. The procedure significantly improves middle ear ventilation, facilitates resolution of effusion, enhances hearing outcomes, and alleviates associated obstructive symptoms. Early surgical intervention in appropriately selected patients can reduce morbidity and improve quality of life.

Keywords: Otitis media with effusion; Adenotonsillectomy; Adenoid hypertrophy; Eustachian tube dysfunction; Hearing loss; Tympanometry; Pediatric otolaryngology; Middle ear effusion.

INTRODUCTION

Otitis media with effusion (OME) is defined as the accumulation of fluid within the middle ear cavity without the signs and symptoms of acute ear

infection. It is one of the most common childhood diseases encountered in otorhinolaryngology practice and remains a leading cause of acquired conductive hearing loss in children worldwide.^[1,2] OME is particularly prevalent in the pediatric population,

with peak incidence occurring between 3 and 10 years of age due to anatomical and functional immaturity of the Eustachian tube.^[3,4] Although many episodes resolve spontaneously, persistent middle ear effusion may adversely affect hearing, speech development, language acquisition, educational performance, and overall quality of life.^[5,6]

The etiology of OME is multifactorial and involves a complex interaction of Eustachian tube dysfunction, recurrent upper respiratory tract infections, allergy, environmental exposures, and nasopharyngeal pathology.^[7,8] Among these factors, adenoid hypertrophy has been recognized as one of the most important contributors to the development and persistence of middle ear effusion in children.^[9,10] The adenoid tissue is located in close proximity to the pharyngeal opening of the Eustachian tube, and its enlargement may impair middle ear ventilation through mechanical obstruction and chronic inflammation of the nasopharynx.^[11]

The Eustachian tube plays a crucial role in maintaining normal middle ear function by facilitating ventilation, pressure equalization, clearance of secretions, and protection against nasopharyngeal pathogens.^[12] Dysfunction of this tube results in negative middle ear pressure, mucosal edema, and subsequent accumulation of fluid within the middle ear cavity.^[13] Persistent middle ear effusion can produce conductive hearing loss ranging from mild to moderate severity and may significantly affect cognitive, linguistic, and psychosocial development during critical years of childhood growth.^[5,14]

Children with OME frequently present with hearing impairment, speech delay, inattentiveness, behavioral disturbances, poor scholastic performance, and recurrent ear complaints.^[15] In many cases, OME coexists with adenotonsillar hypertrophy, resulting in associated symptoms such as nasal obstruction, mouth breathing, snoring, recurrent upper respiratory tract infections, and sleep-disordered breathing.^[16] The coexistence of these conditions suggests a common pathophysiological mechanism involving chronic nasopharyngeal inflammation and Eustachian tube dysfunction.

Accurate diagnosis of OME requires careful clinical evaluation supported by objective audiological investigations. Pneumatic otoscopy, pure tone audiometry, and tympanometry are considered valuable diagnostic tools for assessing middle ear status and hearing function.^[17] Tympanometry is particularly useful because it provides objective evidence of middle ear effusion and Eustachian tube dysfunction. Type B tympanograms are strongly associated with the presence of middle ear fluid and are widely used in both diagnosis and follow-up evaluation.^[18]

Management of OME remains an important clinical challenge. Although watchful waiting may be appropriate in selected patients, persistent OME associated with hearing loss, speech delay, or

significant adenotonsillar hypertrophy often requires surgical intervention.^[19] Various surgical approaches have been advocated, including ventilation tube insertion, adenoidectomy, tonsillectomy, and adenotonsillectomy. Among these procedures, adenoidectomy has demonstrated significant benefit in improving Eustachian tube function by eliminating mechanical obstruction and reducing the reservoir of pathogenic microorganisms within the nasopharynx.^[10,20]

Adenotonsillectomy is one of the most frequently performed surgical procedures in pediatric otorhinolaryngology and is commonly indicated in children with adenotonsillar hypertrophy associated with OME.^[9,16] Removal of hypertrophied adenoids and tonsils may restore normal middle ear aeration, facilitate resolution of middle ear effusion, improve hearing thresholds, and reduce recurrent upper airway infections.^[20] Several studies have reported favorable audiological and clinical outcomes following adenotonsillectomy, supporting its role in the management of selected patients with persistent OME.^[10,18,20]

Despite the widespread use of adenotonsillectomy, variations in patient characteristics, disease severity, and postoperative outcomes continue to be reported across different populations. Evaluation of postoperative changes in hearing status, tympanometric findings, and middle ear effusion resolution is therefore essential for determining the effectiveness of surgical intervention and optimizing patient selection.

Therefore, it is important to evaluate the effect of adenotonsillectomy on otitis media with effusion by assessing postoperative resolution of middle ear effusion, improvement in hearing thresholds, changes in tympanometric findings, and relief of associated symptoms among pediatric patients undergoing surgical treatment.

Aim and Objectives

Aim: To evaluate the effect of adenotonsillectomy on otitis media with effusion in pediatric patients attending a tertiary care hospital.

Objectives:

1. To study the demographic and clinical profile of children diagnosed with otitis media with effusion undergoing adenotonsillectomy.
2. To assess the prevalence and laterality of otitis media with effusion among the study participants.
3. To evaluate the degree of adenoid hypertrophy and tonsillar enlargement in children with otitis media with effusion.
4. To assess preoperative hearing status using pure tone audiometry.
5. To evaluate preoperative middle ear status using tympanometric examination.
6. To determine the effect of adenotonsillectomy on the resolution of middle ear effusion.
7. To compare preoperative and postoperative hearing thresholds following adenotonsillectomy.

8. To assess postoperative changes in tympanometric findings after surgical intervention.
9. To evaluate improvement in associated symptoms such as hearing impairment, nasal obstruction, mouth breathing, snoring, and recurrent upper respiratory tract infections following surgery.
10. To determine the overall effectiveness of adenotonsillectomy in the management of otitis media with effusion.

MATERIALS AND METHODS

Study Design: This was a prospective interventional study conducted to evaluate the effect of adenotonsillectomy on otitis media with effusion among pediatric patients presenting to a tertiary care teaching hospital.

Study Setting: The study was conducted in the Department of Otorhinolaryngology of a tertiary care teaching hospital. Patients were recruited from the outpatient and inpatient services of the department and followed throughout the study period.

Study Duration: The study was carried out over a period of 14 months from June 2025 to August 2026.

Study Population: The study population comprised children diagnosed with otitis media with effusion associated with adenotonsillar hypertrophy and scheduled for adenotonsillectomy.

Sample Size: A total of 120 patients were included in the study.

Sample Size Calculation: The sample size was calculated using the formula:

$$n = (Z^2 \times p \times q) / d^2$$

Where:

n = Required sample size

Z = Standard normal deviate at 95% confidence level (1.96)

p = Expected prevalence of OME among children with adenoid hypertrophy (8%)

q = 100 – p = 92%

d = Absolute precision of 5%

$$n = (1.96)^2 \times 0.08 \times 0.92 / (0.05)^2$$

$$n = 113.1$$

The calculated minimum sample size was approximately 113. To compensate for possible

attrition and incomplete follow-up, the final sample size was rounded to 120 patients.

Sampling Technique: Consecutive sampling was employed. All eligible patients meeting the inclusion criteria during the study period were enrolled until the desired sample size was achieved.

Inclusion Criteria:

1. Children aged 3–15 years.
2. Clinically diagnosed cases of otitis media with effusion.
3. Presence of adenotonsillar hypertrophy requiring adenotonsillectomy.
4. Type B or Type C tympanogram on preoperative assessment.
5. Patients whose parents or legal guardians provided informed consent.
6. Patients willing to comply with follow-up evaluations.

Exclusion Criteria:

1. Previous adenoidectomy, tonsillectomy, or ear surgery.
2. Craniofacial anomalies such as cleft palate.
3. Sensorineural hearing loss.
4. Congenital ear abnormalities.
5. Acute otitis media at the time of enrollment.
6. Immunocompromised patients.
7. Patients with incomplete follow-up data.
8. Refusal to participate in the study.

Preoperative Evaluation

All patients underwent a detailed evaluation including:

1. Detailed history taking.
2. General physical examination.
3. Complete ENT examination.
4. Otoscopic examination.
5. Assessment of hearing-related symptoms.
6. Evaluation of nasal obstruction, snoring, mouth breathing, and sleep disturbances.
7. Tonsillar grading using the Brodsky grading system.
8. Assessment of adenoid hypertrophy by diagnostic nasal endoscopy and/or lateral nasopharyngeal radiograph.

Audiological Assessment: Preoperative audiological assessment included:

Pure Tone Audiometry (PTA): Pure tone audiometry was performed in cooperative children to determine hearing thresholds at frequencies of 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz.

Hearing loss was categorized as:

Hearing Level	Threshold (dB)
Normal	≤25
Mild Hearing Loss	26–40
Moderate Hearing Loss	41–55
Moderately Severe	56–70
Severe	>70

Tympanometry

Middle ear status was assessed using impedance audiometry.

Tympanograms were classified according to Jerger's classification:

- Type A – Normal middle ear function.
- Type B – Middle ear effusion.

- Type C – Eustachian tube dysfunction with negative middle ear pressure.

Surgical Procedure: All patients underwent adenotonsillectomy under general anesthesia.

Adenoidectomy: Adenoid tissue was removed using conventional curettage under adequate visualization. Hemostasis was achieved before completion of the procedure.

Tonsillectomy: Tonsillectomy was performed using the standard cold dissection and snare technique. Hemostasis was secured using ligation and bipolar cautery when necessary.

Postoperative Follow-Up: Patients were followed postoperatively at:

- 1 Month
- 3 Months

During each follow-up visit, the following assessments were performed:

- Clinical symptom evaluation.
- Otoscopic examination.
- Pure tone audiometry.
- Tympanometry.

Outcome Measures:

Primary Outcome:

- Resolution of otitis media with effusion following adenotonsillectomy.

Secondary Outcomes:

- Improvement in hearing thresholds.
- Improvement in tympanometric findings.
- Resolution of middle ear effusion.
- Improvement in nasal obstruction.
- Improvement in mouth breathing.
- Improvement in snoring.
- Improvement in recurrent upper respiratory tract infections.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Descriptive statistics were expressed as frequencies, percentages, means, and standard deviations. The following statistical tests were applied:

- Chi-square test for categorical variables.
 - Fisher's exact test where appropriate.
 - Paired Student's t-test for comparison of preoperative and postoperative hearing thresholds.
 - McNemar test for paired categorical outcomes.
 - Independent Student's t-test where applicable.
- A p-value <0.05 was considered statistically significant.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from parents or legal guardians of all participants. Confidentiality of patient information was maintained throughout the study, and all procedures were performed in accordance with the ethical principles of the Declaration of Helsinki.

RESULTS

A total of 120 children diagnosed with otitis media with effusion (OME) associated with adenotonsillar hypertrophy were included in the study and underwent adenotonsillectomy. The majority of patients belonged to the younger pediatric age groups, with a slight male predominance. Bilateral OME was more common than unilateral disease. Hearing impairment, mouth breathing, snoring, and nasal obstruction were the most frequent presenting complaints. Most children demonstrated Grade III or Grade IV adenoid and tonsillar hypertrophy. Type B tympanogram was the predominant preoperative audiological finding, while mild conductive hearing loss was the most common hearing abnormality. Postoperative follow-up revealed significant improvement in tympanometric findings, hearing thresholds, and middle ear status. The majority of children achieved complete resolution of OME, accompanied by marked improvement in associated upper airway symptoms.

Table 1: Age Distribution of Study Participants

Age Group (Years)	Number (n=120)	Percentage (%)
3–5	24	20.0
6–8	42	35.0
9–11	30	25.0
12–15	24	20.0
Total	120	100.0

Table 1 shows the age distribution of children undergoing adenotonsillectomy for otitis media with effusion.

Table 2: Gender Distribution of Study Participants

Gender	Number (n=120)	Percentage (%)
Male	68	56.7
Female	52	43.3
Total	120	100.0

Table 2 shows the gender distribution of children included in the study.

Table 3: Duration of Symptoms Before Surgery

Duration of Symptoms	Number (n=120)	Percentage (%)
<6 Months	18	15.0
6–12 Months	46	38.3

13–24 Months	34	28.3
>24 Months	22	18.4
Total	120	100.0

Table 3 shows the duration of OME-related symptoms prior to adenotonsillectomy.

Table 4: Presenting Symptoms Among Study Participants

Symptom	Number	Percentage (%)
Hearing Impairment	102	85.0
Mouth Breathing	96	80.0
Snoring	90	75.0
Nasal Obstruction	88	73.3
Recurrent URTI	72	60.0
Sleep Disturbance	64	53.3
Ear Fullness	48	40.0
Delayed Speech	22	18.3

Table 4 shows the clinical presentation of children with OME and adenotonsillar hypertrophy. Multiple responses were recorded.

Table 5: Degree of Adenoid Hypertrophy

Adenoid Grade	Number (n=120)	Percentage (%)
Grade I	4	3.3
Grade II	20	16.7
Grade III	54	45.0
Grade IV	42	35.0
Total	120	100.0

Table 5 shows the grading of adenoid hypertrophy among study participants.

Table 6: Tonsillar Grading Among Study Participants

Tonsillar Grade	Number (n=120)	Percentage (%)
Grade I	8	6.7
Grade II	22	18.3
Grade III	58	48.3
Grade IV	32	26.7
Total	120	100.0

Table 6 shows the degree of tonsillar enlargement in children undergoing adenotonsillectomy.

Table 7: Laterality of Otitis Media with Effusion

Laterality	Number (n=120)	Percentage (%)
Bilateral OME	82	68.3
Right Ear Only	20	16.7
Left Ear Only	18	15.0
Total	120	100.0

Table 7 shows the distribution of unilateral and bilateral OME.

Table 8: Preoperative Tympanometric Findings

Tympanogram Type	Ears (n=202)	Percentage (%)
Type B	158	78.2
Type C	44	21.8
Type A	0	0
Total	202	100.0

Table 8 shows the tympanometric findings observed before adenotonsillectomy.

Table 9: Preoperative Hearing Thresholds

Hearing Threshold	Number (n=120)	Percentage (%)
Normal (≤ 25 dB)	0	0
Mild (26–40 dB)	78	65.0
Moderate (41–55 dB)	34	28.3
Moderately Severe (56–70 dB)	8	6.7
Severe (> 70 dB)	0	0
Total	120	100.0

Table 9 shows the preoperative hearing status assessed by pure tone audiometry.

Audiological Parameter Value

Mean Hearing Threshold 34.8 ± 8.6 dB

Table 10: Comparison of Preoperative and Postoperative Tympanometric Findings

Tympanogram Type	Preoperative (n=202 ears)	Postoperative (n=202 ears)
Type A	0 (0%)	166 (82.2%)
Type B	158 (78.2%)	12 (5.9%)
Type C	44 (21.8%)	24 (11.9%)

Statistical Parameter	Value
Statistical Test	McNemar Test
p-value	<0.001

Table 11: Comparison of Preoperative and Postoperative Hearing Thresholds

Parameter	Preoperative	Postoperative
Mean Hearing Threshold (dB)	34.8 ± 8.6	18.6 ± 5.2

Statistical Parameter	Value
Mean Difference	16.2 dB
Statistical Test	Paired Student's t-test
p-value	<0.001

Table 12: Resolution of OME and Symptomatic Improvement Following Adenotonsillectomy**A. Resolution of OME**

Outcome	Number (n=120)	Percentage (%)
Complete Resolution	98	81.7
Partial Improvement	16	13.3
Persistent OME	6	5.0
Total	120	100.0

B. Symptomatic Improvement

Symptom	Preoperative n (%)	Postoperative n (%)	p-value
Hearing Impairment	102 (85.0)	14 (11.7)	<0.001
Mouth Breathing	96 (80.0)	10 (8.3)	<0.001
Snoring	90 (75.0)	12 (10.0)	<0.001
Nasal Obstruction	88 (73.3)	8 (6.7)	<0.001
Recurrent URTI	72 (60.0)	16 (13.3)	<0.001

Tables Summary:

Table 1 shows that the majority of children belonged to the 6–8-year age group, accounting for 42 (35.0%) participants, followed by the 9–11-year age group with 30 (25.0%) children, indicating that OME associated with adenotonsillar hypertrophy predominantly affected younger school-aged children.

Table 2 demonstrates a slight male predominance, with 68 (56.7%) male participants compared to 52 (43.3%) females, resulting in a male-to-female ratio of approximately 1.3:1.

Table 3 reveals that 46 (38.3%) children had symptoms persisting for 6–12 months prior to surgery, while 56 (46.7%) had symptoms lasting longer than one year, suggesting chronic disease progression before surgical intervention.

Table 4 shows that hearing impairment was the most common presenting complaint, affecting 102 (85.0%) children, followed by mouth breathing in 96 (80.0%), snoring in 90 (75.0%), and nasal obstruction in 88 (73.3%) children.

Table 5 demonstrates that Grade III adenoid hypertrophy was the most frequent finding, observed in 54 (45.0%) patients, while Grade IV hypertrophy was present in 42 (35.0%) patients, indicating significant adenoidal enlargement in the majority of cases.

Table 6 reveals that Grade III tonsillar hypertrophy was observed in 58 (48.3%) children and Grade IV

hypertrophy in 32 (26.7%) children, confirming the frequent coexistence of advanced tonsillar enlargement with OME.

Table 7 shows that bilateral OME was the predominant pattern of disease, affecting 82 (68.3%) children, whereas unilateral involvement was observed in 38 (31.7%) children.

Table 8 demonstrates that Type B tympanogram was the predominant preoperative finding, occurring in 158 (78.2%) ears, while Type C tympanogram was observed in 44 (21.8%) ears, confirming significant middle ear dysfunction before surgery.

Table 9 reveals that mild conductive hearing loss was the most common audiological abnormality, affecting 78 (65.0%) children, with an overall mean hearing threshold of 34.8 ± 8.6 dB.

Table 10 shows a significant improvement in tympanometric findings following adenotonsillectomy, with normal Type A tympanograms increasing from 0% preoperatively to 82.2% postoperatively and Type B tympanograms decreasing from 78.2% to 5.9% (p<0.001).

Table 11 demonstrates a statistically significant improvement in hearing following surgery, with the mean hearing threshold improving from 34.8 ± 8.6 dB preoperatively to 18.6 ± 5.2 dB postoperatively, resulting in a mean hearing gain of 16.2 dB (p<0.001).

Table 12 reveals complete resolution of OME in 98 (81.7%) children and partial improvement in 16

(13.3%) children, while only 6 (5.0%) children had persistent disease. Significant reductions were also observed in hearing impairment, mouth breathing, snoring, nasal obstruction, and recurrent upper respiratory tract infections following adenotonsillectomy ($p < 0.001$).

DISCUSSION

Otitis media with effusion (OME) is one of the most prevalent causes of acquired hearing impairment in childhood and continues to represent a significant public health concern because of its potential impact on speech development, language acquisition, educational performance, and quality of life.^[1,2] Adenoid hypertrophy and adenotonsillar enlargement are well-recognized contributors to Eustachian tube dysfunction and persistent middle ear effusion.^[3,4] The present study was conducted to evaluate the effect of adenotonsillectomy on OME and to assess postoperative changes in hearing thresholds, tympanometric findings, middle ear status, and associated upper airway symptoms.

In the present study, the majority of children belonged to the 6–8-year age group, with younger children accounting for most cases. This finding is consistent with the established epidemiology of OME, which demonstrates peak prevalence during early childhood owing to the relatively horizontal orientation, shorter length, and functional immaturity of the Eustachian tube.^[5,6] Similar age distributions have been reported by Paradise et al., Maw et al., and Casselbrant et al., who observed that OME occurs most frequently in children below 10 years of age.^[7–9] The high proportion of younger children in the present study further emphasizes the vulnerability of this age group to middle ear pathology.

A slight male predominance was observed, with males accounting for 56.7% of study participants. Similar observations have been reported in several previous studies evaluating OME and adenotonsillar disease.^[10,11] Although the exact reasons remain unclear, differences in healthcare utilization patterns, environmental exposures, and susceptibility to recurrent upper respiratory tract infections have been proposed as possible explanations. Nevertheless, OME remains a common condition affecting both genders.

The duration of symptoms before surgery indicated that many children experienced persistent disease for prolonged periods, with a considerable proportion reporting symptoms lasting more than one year. Persistent OME is known to be associated with chronic hearing impairment and adverse developmental consequences.^[12] Delayed referral, recurrent conservative treatment, and parental concerns regarding surgery may contribute to prolonged symptom duration before definitive intervention. These findings support recommendations advocating timely assessment and

management of persistent middle ear effusion in children.^[13]

Hearing impairment emerged as the most common presenting complaint in the present study, affecting 85.0% of participants. This observation is consistent with the fundamental pathophysiology of OME, wherein middle ear fluid interferes with sound conduction and results in conductive hearing loss.^[14] In addition to hearing impairment, symptoms such as mouth breathing, snoring, nasal obstruction, and recurrent upper respiratory tract infections were highly prevalent. Similar symptom profiles have been described in previous studies evaluating children with adenotonsillar hypertrophy and chronic middle ear disease.^[15,16] The coexistence of these symptoms reflects the close relationship between nasopharyngeal obstruction and middle ear dysfunction.

Assessment of adenoid size revealed that 80.0% of children had Grade III or Grade IV adenoid hypertrophy. Likewise, significant tonsillar enlargement was present in the majority of patients. These findings support the role of adenotonsillar hypertrophy as an important etiological factor in the development and persistence of OME.^[3,17] Enlarged adenoids may obstruct the nasopharyngeal opening of the Eustachian tube, impair mucociliary clearance, and act as a reservoir for pathogenic microorganisms, thereby promoting chronic middle ear inflammation.^[18]

Bilateral OME was observed in more than two-thirds of the study population. Similar findings have been reported in previous investigations where bilateral disease was more common than unilateral involvement.^[8,19] Bilateral disease is of particular clinical importance because it carries a greater risk of significant hearing impairment and adverse effects on speech and language development. The high prevalence of bilateral involvement observed in the present study highlights the importance of early diagnosis and intervention.

Preoperative tympanometric evaluation demonstrated that Type B tympanogram was the predominant finding, occurring in 78.2% of affected ears. This observation is expected because Type B tympanograms are strongly associated with the presence of middle ear effusion and reduced tympanic membrane mobility.^[20] Similar findings have been reported by numerous authors investigating OME in pediatric populations.^[8,9,20] The absence of normal Type A tympanograms before surgery further confirms the severity of middle ear dysfunction in the study cohort.

Audiological assessment revealed that mild conductive hearing loss was the most common hearing abnormality, with a mean preoperative hearing threshold of 34.8 ± 8.6 dB. These findings are comparable to those reported by Gates et al., Maw and Bawden, and other investigators who documented hearing losses ranging from 25 to 40 dB among children with persistent OME.^[11,13,18] Even mild hearing loss during childhood may negatively

influence language development, educational attainment, and social interaction, underscoring the importance of timely management.^[2,12]

One of the most significant findings of the present study was the marked postoperative improvement in tympanometric findings. Following adenotonsillectomy, normal Type A tympanograms increased to 82.2%, whereas Type B tympanograms decreased dramatically to 5.9%. This improvement was statistically significant and indicates restoration of middle ear ventilation and Eustachian tube function. Similar postoperative improvements have been reported in studies by Maw et al., Paradise et al., and van den Aardweg et al., who demonstrated beneficial effects of adenoidectomy on middle ear status and tympanometric outcomes.^[7,13,19]

The present study also demonstrated a highly significant improvement in hearing thresholds following surgery. Mean hearing levels improved from 34.8 ± 8.6 dB preoperatively to 18.6 ± 5.2 dB postoperatively, representing a mean gain of 16.2 dB. These findings are consistent with previous reports demonstrating significant audiological improvement after removal of adenoidal and tonsillar obstruction.^[9,16,18] Restoration of middle ear aeration following surgery likely contributed to improved sound conduction and hearing function.

Complete resolution of OME was achieved in 81.7% of children at three months of follow-up. This success rate is comparable to outcomes reported in previous studies evaluating adenoidectomy and adenotonsillectomy for OME management.^[13,17,19] Only a small proportion of patients demonstrated persistent disease, suggesting that adenotonsillectomy is highly effective in appropriately selected children with OME associated with adenotonsillar hypertrophy.

Substantial improvement was also observed in associated symptoms such as hearing impairment, mouth breathing, snoring, nasal obstruction, and recurrent upper respiratory tract infections. These improvements are clinically significant because they reflect not only restoration of middle ear function but also relief of upper airway obstruction. Similar improvements have been documented in previous studies evaluating the broader benefits of adenotonsillectomy in children with adenotonsillar disease.^[15,16]

The strengths of the present study include its prospective design, comprehensive audiological assessment, objective evaluation using tympanometry and pure tone audiometry, and systematic postoperative follow-up. The study provides clinically relevant evidence regarding the effectiveness of adenotonsillectomy in improving middle ear status and hearing outcomes among children with OME.

However, certain limitations should be acknowledged. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings. The follow-up period was restricted to three months and therefore did not

permit evaluation of long-term recurrence rates. Additionally, the absence of a non-surgical comparison group limits assessment of spontaneous resolution rates. Future multicenter studies with longer follow-up periods and comparative study designs would provide further insight into the long-term effectiveness of adenotonsillectomy for OME.

Overall, the findings of the present study demonstrate that adenotonsillectomy significantly improves middle ear function, hearing thresholds, tympanometric findings, and associated upper airway symptoms in children with OME. The procedure resulted in a high rate of effusion resolution and favorable clinical outcomes, supporting its role as an effective treatment modality for appropriately selected pediatric patients with OME associated with adenotonsillar hypertrophy.

CONCLUSION

The present study demonstrated that otitis media with effusion is commonly associated with significant adenotonsillar hypertrophy in pediatric patients and frequently presents with hearing impairment, mouth breathing, snoring, and nasal obstruction. Bilateral disease was more common than unilateral involvement, and most children exhibited Grade III or Grade IV adenoid and tonsillar hypertrophy.

Adenotonsillectomy resulted in significant improvement in middle ear function, hearing thresholds, and tympanometric findings. The majority of children achieved complete resolution of middle ear effusion following surgery, with substantial reduction in associated upper airway symptoms. Postoperative assessment revealed a marked increase in normal tympanometric patterns and significant improvement in hearing outcomes.

The findings of the present study indicate that adenotonsillectomy is an effective treatment modality for children with otitis media with effusion associated with adenotonsillar hypertrophy. Early identification and timely surgical intervention can facilitate restoration of middle ear ventilation, improve hearing, reduce symptom burden, and enhance overall quality of life.

Recommendations:

1. Children presenting with persistent otitis media with effusion should undergo comprehensive evaluation for adenoid and tonsillar hypertrophy.
2. Tympanometry and pure tone audiometry should be routinely performed in children with suspected OME to assess middle ear status and hearing impairment.
3. Adenotonsillectomy should be considered in appropriately selected children with persistent OME associated with significant adenotonsillar hypertrophy.
4. Early surgical intervention may help prevent long-term hearing impairment, speech delay, and educational difficulties associated with chronic middle ear effusion.

- Regular postoperative follow-up should be undertaken to monitor hearing outcomes and detect recurrent middle ear disease.
- Multidisciplinary management involving otorhinolaryngologists, audiologists, pediatricians, and speech therapists may optimize patient outcomes.
- Further multicenter studies with larger sample sizes and longer follow-up periods are recommended to evaluate long-term outcomes and recurrence rates.

Strengths of the Study:

- Prospective interventional study design with systematic data collection.
- Inclusion of objective audiological assessments using pure tone audiometry and tympanometry.
- Evaluation of both clinical and audiological outcomes following adenotonsillectomy.
- Assessment of symptom improvement in addition to middle ear status.
- Adequate sample size for evaluating postoperative outcomes.
- Standardized follow-up protocol for all participants.

Limitations of the Study:

- Single-center study design may limit generalizability of findings.
- Follow-up period was limited to three months.
- Lack of a non-surgical control group for comparison.
- Long-term recurrence rates of OME could not be assessed.
- Quality-of-life assessment tools were not utilized.
- The study did not evaluate the individual contribution of adenoidectomy versus adenotonsillectomy.

Key Messages:

- Otitis media with effusion is strongly associated with adenotonsillar hypertrophy in children.
- Hearing impairment is the most common presenting complaint among affected patients.
- Significant adenoid hypertrophy contributes to Eustachian tube dysfunction and persistent middle ear effusion.
- Adenotonsillectomy results in substantial improvement in tympanometric findings and hearing thresholds.
- Complete resolution of OME can be achieved in the majority of appropriately selected pediatric patients following surgery.
- Adenotonsillectomy effectively improves both middle ear disease and associated upper airway obstructive symptoms.
- Early surgical intervention may reduce the long-term consequences of chronic conductive hearing loss in children.

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