The Outcome of Adenoidectomy and Tympanostomy Tube Insertion in Patients with Otitis Media with Effusion and Factor that Influences the Recurrence

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ABSTRACT

Objective: The adenoid is an important contributing factor for otitis media with effusion by serving as the reservoir for pathogenic bacteria. Adenoidectomy is suggested in the guidelines as an adjunctive surgical treatment for otitis media with effusion. Recurrence of otitis media after adenoidectomy should be evaluated and concomitant adenoidal diseases should be taken into consideration. The objective of this study was to evaluate the outcome of the patients who had simultaneous adenoidectomy and tympanostomy tube insertion, in terms of recurrence of otitis media, adenoid-related diseases and repeated surgery.

Methods: A retrospective study was performed in those patients who had adenoidectomy with tympanostomy tube insertion during 1994-2003. Medical records were reviewed from the time of surgery until the last contact of each patient. Data collection included indications for surgery, culture results, post-operative recurrence of otitis media, adenoid-related diseases and additional operations.

Results: There were sixty-six patients with 47 boys and 19 girls. The mean age was 6.27 ± 3.05 years. Co-existing adenoidal diseases consisted of rhinosinusitis (54.5%), obstructive sleep disorder (42.4%), and adenotonsillitis (3%). Nine cases (13.6%) had no associated adenoidal disease. and adenoidectomy was done in conjunction with the insertion of their second set of tympanostomy tubes. The predominant bacteria from the adenoid cultures were *Streptococcus pneumoniae* (21.7%), *Pseudomonas aeruginosa* (21.7%) and *Streptococcus viridans* (17.4%). The mean period of follow up was 23.8 months. Forty-one patients (62.1%) had no recurrence of otitis media. Nine cases (13.6%) had repeated myringotomy and tube insertion. Significant correlation was found between recurrent rhinosinusitis and recurrent otitis media ($p = 0.001$). The relative risk of recurrent otitis media in patients with recurrent rhinosinusitis was 3.63 (95% CI 1.4 to 9.4).

Conclusion: Simultaneous adenoidectomy with tympanostomy tube insertion produced satisfactory results in reducing the recurrence of otitis media during the follow-up period. Recurrent rhinosinusitis was correlated with recurrent otitis media and repeated myringotomy and tube insertion.

Keywords: Otitis media, adenoidectomy, tympanostomy tube

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INTRODUCTION

The adenoid is a part of the Waldeyer's ring of lymphoid tissue in the nasopharynx. As the adenoid is located in the vicinity of the Eustachian tube and the nasal cavity, its infection plays an important part in upper respiratory tract infections in children. The adenoid has been recognized as one of the contributing factors of otitis media by obstructing the Eustachian tube and being the reservoir of pathogenic bacteria.[1] The adenoid is also a possible source of infection in pediatric rhinosinusitis.[2] There has been a study that proved the matching of bacteria in the middle meatal swab and the adenoid core culture.[3] Infection of the adenoid can cause hypertrophy of the gland, resulting in nasal obstruction and obstructive sleep disorder. Adenoidectomy has been accepted as one of the treatment modalities for otitis media, sinusitis and obstructive sleep apnea.[4-6] Simultaneous operation of the adenoid and the middle ear is indicated in patients with otitis media with effusion (OME) and co-existing adenoid diseases.[4] Adenoidectomy with myringotomy and ventilation tube insertion should reduce the recurrence of otitis media and improve the symptoms of adenoid-related diseases. In this series, we studied the patients with otitis media with

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effusion who had associated diseases of the adenoid and had undergone simultaneous adenoidectomy with myringotomy and ventilation tube insertion. The objective was to evaluate the outcome of surgery in the view of recurrence of otitis media with effusion and the relief of adenoidal diseases. The relationship between adenoidal diseases and recurrences of otitis media with effusion was studied. The expected clinical application was to find the appropriate treatment for recurrence otitis media in patients with and without concomitant adenoidal diseases in order to prevent or reduce the need for further surgery. Management of adenoid-related diseases may have an important role in reducing the recurrence of otitis media .

MATERIALS AND METHODS

A retrospective cohort study was conducted at the Pediatric Otolaryngology Clinic of the Department of Otolaryngology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand. The study was approved by the institutional review board and ethical committee of the faculty. Medical records of the patients with otitis media with effusion who had adenoidectomy in the same setting with myringotomy and ventilation tube insertion during 1994-2003 were reviewed. The parents of the patients who were still following in the Pediatric Otolaryngology Clinic were also informed of the review. The author was the only surgeon who operated on all of the patients in this series. Data collection included demographic data, detailed history, physical examinations and investigations of ear infections and associated diseases. Otitis media with effusion is defined by the appearance of fluid in the middle ear diagnosed by pneumatic otoscopy. Associated diseases of the adenoid in this series consisted of rhinosinusitis and hypertrophic adenoids causing obstructive sleep disorder. Rhinosinusitis was defined by the history of upper respiratory tract infections for more than 10 days, nasal obstruction, cough, halitosis and presence of mucous discharge from the middle meatus from physical examination. Film paranasal sinus series, including lateral skull films were done in all patients who had symptoms of adenoid-related diseases. Obstructive sleep disorder from their adenoid was documented by a history of snoring, interrupted sleep by apnea or awakening, open mouth breathing and lateral skull x-ray showing adenoid-nasopharyngeal ratio greater than 0.7. Allergic history and allergy skin test were recorded. The types of operation were recorded and categorized. Middle ear fluid cultures and adenoid cultures were reviewed. Post-operative visits were reviewed until the last contact with the patients for the documented episodes of otorrhea, recurrent otitis media, rhinosinusitis and obstructive sleep disorder. Additional or repeated operations during the follow up period were recorded. Descriptive statistics were used to analyze the demographic data, diagnosis, investigations, management and outcome of otitis media and associated diseases. Pearson's Chi-square or Fisher's Exact test was used to determine the relationship between adenoid-related diseases and the outcome of surgery. Relative risk and confidence interval was calculated to define the association of adenoid-related diseases and recurrent otitis media with effusion. Statistical analysis was done by the SPSS program version 11.5.

RESULTS

Between March 1994 and October 2003, 66 children with otitis media with effusion underwent adenoidectomy with myringotomy and tympanostomy tube insertion. There were 47 boys and 19 girls. The mean age was 6.27 ± 3.05 years. The reasons for the operation have been classified in Table 1. Adenoidectomy was done in conjunction with insertion of the first set of tympanostomy tubes in patients with associated diseases of the adenoid. Fifty-seven cases had adenoid diseases consisting of obstructive sleep disorder (42.4%), rhinosinusitis (54.5%) and chronic adenotonsillitis (3%). Nine cases (13.6%) had OME with no associated diseases. In these nine patients, adenoidectomy was done in conjunction with the insertion of their second set of tympanostomy tubes in order to eliminate the source of infection in the nasopharynx. In this series, 31 cases had allergy skin test. The tests were positive for at least one inhalant allergen in 15 cases (48.4%) and negative for all allergens in 16 cases (51.6%). The details of the surgical procedures were bilateral myringotomy with tympanostomy tube insertion with adenoidectomy in 41 cases (62.1%), bilateral myringotomy with tympanostomy tube insertion with adenotonsillectomy in 19 cases (28.8%), unilateral myringotomy with tympanostomy tube insertion with adenoidectomy in 4 cases (6.1%) and unilateral myringotomy with tympanostomy tube insertion with adenotonsillectomy in 2 cases (3.0%).

TABLE 1. Reasons for operation.

	Frequency	Percent
OME* & rhinosinusitis	27	40.9
OME & OSD**	19	28.8
OME only	9	13.6
OME & OSD & sinusitis	9	13.6
OME & adenotonsillitis	2	3.0
Total	66	100.0

*OME = otitis media with effusion
**OSD = obstructive sleep disorder

Adenoid and middle ear fluids were sent for culture. The results of 23 specimens of the adenoid and 51 specimens of the middle ear fluids were reviewed. *Streptococcus pneumoniae*, *Pseudomonas aeruginosa* and *Streptococcus viridans* were predominant in the adenoid cultures (Table 2). No growth was found in only 2 specimens (8.7%). In contrast to the adenoid, middle ear fluid culture showed no growth in 45 specimens (88.2%). The positive specimens of middle ear fluid culture consisted of 2 (3.9%) *Haemophilus influenzae* with positive beta-lactamase, 3 (5.9%) *Staphylococcus aureus* and 1 (2%) Coagulase negative staphylococcus.

TABLE 2. Results of adenoid culture.

Organisms	Specimens	Percent
Streptococcus pneumoniae	5	21.7
Pseudomonas aeruginosa	5	21.7
Streptococcus viridans	4	17.4
Normal flora	3	13.0
Staphylococcus aureus	2	8.7
Beta-hemolytic streptococci	2	8.7
Klebsiella pneumoniae	2	8.7
Streptococcus group B	1	4.3
Proteus spp.	1	4.3
Haemophilus influenzae type B	1	4.3
Moraxella catarrhalis	1	4.3
No growth	2	8.7

TABLE 3. Relative risk of recurrent sinusitis and recurrent otitis media with effusion.

	Recurrent OME* (+)	Recurrent OME (-)	Total
Recurrent sinusitis (+)	21	18	39
Recurrent sinusitis (-)	4	23	27
Total	25	41	66
Relative risk (95% CI)			3.63 (1.4-9.4)

*OME = otitis media with effusion

The patients were followed up after the operation for the mean period of 23.8 months. Forty-one patients (62.1%) had no recurrence of otitis media, 13 patients (19.7%) had one recurrence and 12 patients had more than one recurrence during the follow-up period. Nine cases (13.6%) had at least one episode of otorrhea through their tube, which was treatable with ototopical antibiotics without removal of their tubes. Nine cases (13.6%) had recurrent otitis media with effusion that reached the criteria for surgical intervention and repeated bilateral myringotomy and tube insertion was done. The mean duration between the first procedure and the repeated procedure was 13.5 months with a median of 9 months.

The patients were followed for recurrences of adenoid-associated diseases after the operation. At least one episode of recurrent rhinosinusitis occurred in 39 cases (59.1%). Only 2 cases (3%) had recurrence of obstructive sleep disorder. Fisher's Exact test showed significant association between recurrent rhinosinusitis and repeated tympanostomy tube insertion ($p = 0.008$). Pearson's correlation showed significant correlation between recurrent rhinosinusitis and recurrent otitis media with effusion ($r = 0.4$, $p = 0.001$). The relative risk of patients with recurrent rhinosinusitis to have recurrent otitis media with effusion was 3.63 (95% CI= 1.4 to 9.4, Table 3).

DISCUSSION

The adenoid is the lymphoid tissue which consists of 50% of B-lymphocytes and 50% of T-lymphocytes.[7] Its function is active in children until they reach 7-10 years of age.[8] The function of the adenoid includes immunological function as the primed B cells in the adenoid initiate the production of both local and systemic immunoglobulin. Adenoid surface secretion contains immunoglobulin and inflammatory mediators.[9] On the other hand, the adenoid and the nasopharynx harbor many kinds of bacterial flora. The adenoid, regardless of its size, is the reservoir of pathogenic bacteria for otitis media and rhinosinusitis such as *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Moraxella catarhallis*.[10, 11] By the anatomical location, the adenoid can cause obstruction or compression of the Eustachian tube opening at the nasopharyngeal end and be another contributing factor for otitis media. A hypertrophic adenoid is also the cause of nasal obstruction and obstructive sleep disorder.

For the above reason, otitis media, rhinosinusitis and obstructive sleep disorder in children are concomitant diseases by the involvement of the adenoid. Suzuki[10] reported that the incidence of sinusitis in children with OME was 57%, which is closely similar to this series, while the incidence of sinusitis in the children without OME is much lower. Hong et al[12] reported that the concomitant rate between sinusitis and OME was 15.4% in patients who had adenotonsillectomy and 68.9% of patients with OME had sinusitis. Ungkanont and Damrongsak[13] reported the incidence of 27% of concomitant OME found in patients who had adenoidectomy for pediatric sinusitis. In the same series, obstructive sleep disorder was found in association with rhinosinusitis in 64.9% of patients.[13] Inflammation and deterioration of the mucosal barrier in the nasopharynx, ciliary dysfunction, squamous metaplasia and decreased mucosal production of IgA was found in the adenoid of the patients with concomitant sinusitis and OME.[10, 12]

Adenoidectomy has been proven to be an effective modality in the treatment of otitis media with effusion. It is recommended in children with recurrent middle ear effusion that need a second set of tympanostomy tube insertion.[4] The guidelines state that, for patients who need repeated myringotomy for recurrent middle ear effusion, adenoidectomy should be done in order to eradicate the source of infection for otitis media, whether the adenoid is hypertrophic or not. In this study, nine cases without adenoidal diseases had adenoidectomy with ventilation tube insertion. These 9 patients had recurrent middle ear effusion that met the criteria for repeated surgery and they all had operations for their second set of tubes. It is also recommended in patients with obstructive adenoids or recurrent sinonasal infections.[14] Nguyen et al[15] suggested that the selection criteria for adenoidectomy in patients with otitis media with abutting adenoid on the torus tubarius will have more benefit with less recurrent rate of middle ear effusion. In our study, an obstructive adenoid was found in 28 cases (42.4%) and the result of adenoidectomy was most satisfactory in relieving obstructive sleep disorder with only 2 cases of recurrence.

The Cochrane review in 2010[16] demonstrated the beneficial effect of adenoidectomy on the resolution of middle ear effusion and the advantages of concomitant adenoidectomy with tympanostomy tube insertion over tympanostomy tube alone, based on tympanometry and otoscopic examination at 6 and 12 months. Saylam et al[17] found thicker bacterial biofilm in the adenoid samples removed from the patients with chronic OME than from the control group and they concluded that adenoid bacterial biofilm may be associated with OME. Adenoidectomy is the removal of bacterial biofilm which is the source of chronic infection. Regarding the bacteriology in this study, the adenoid core culture and middle ear fluid culture did not match. As it is a retrospective review, the uniform technique of handling the specimens and uniform culture technique could not be obtained. However, pathogenic bacteria for otitis media were found in both adenoid and middle ear fluid cultures, such as *Streptococcus pneumoniae* from the adenoid and *Haemophilus influenzae* from the middle ear fluid. It is now known from recent literatures[18] that middle ear fluid culture usually yields no growth because bacteria are mostly embedded in the bacterial biofilm on the surface of the middle ear mucosa rather than floating in the middle ear fluid.

Kadhim et al[19] reported the reduced odds ratio for repeated ventilation tube insertion in children who had adenoidectomy or adenotonsillectomy in addition to their first myringotomy, suggesting that adenoidectomy should reduce the number of further surgeries in patients with OME. In our study, 62.1% of the patients had no recurrence during the follow up period and only 9 cases (13.6%) had repeated ventilation tube insertion.

CONCLUSION

Simultaneous adenoidectomy with tympanostomy tube insertion in patients with OME provided a satisfactory result in reducing both recurrences and the need for repeated surgery during the follow up period. Recurrence of OME and repeated tympanostomy tube insertion were associated with the recurrence of rhinosinusitis. For the associated diseases of the adenoid, adenoidectomy is most beneficial in reducing the recurrence of obstructive sleep disorder.

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