

Retrospective Review of Grommet Insertions for Otitis Media with Effusion in Children in Singapore

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SUMMARY

Otitis media with effusion is one of the most common childhood infections, and grommet insertions are done for chronic otitis media which have failed medical therapy. The aims of this study were 1) to determine the patient profile of children needing grommet insertion and 2) to determine if grommet insertion is safe and effective. A retrospective review of 105 children with myringotomy and grommet insertions for chronic otitis media with effusion between 2006 and 2008 was performed. Seventy two percent of patients were younger than 6 years old. Male to female ratio was 4:3. Twelve percent of patients were syndromic. In children with otitis media with effusion, hearing and academic performance improved after grommet insertion. Allergic rhinitis and cleft palate are risk factors for chronic middle ear effusion.

KEY WORDS:

Otitis Media with Effusion, Grommet, Hearing and Academic performance

INTRODUCTION

Otitis media with effusion (OME) or "glue ear" is defined as middle ear effusion without signs or symptoms of an acute infection of otalgia, otorrhea, fever and irritability. It is very common in children, especially between the ages of 1 and 3 years, with a prevalence of 10% to 30% and a cumulative incidence of 80% at the 4 years old¹. It may occur spontaneously because of poor eustachian tube function, or after acute otitis media. Many episodes resolve spontaneously within 3 months, but 30% to 40% of children have recurrent OME and 5% to 10% of episodes last 1 year or longer².

OME results in conductive hearing loss averaging 30dBHL, ranging from 5 to 50 dBHL. Hearing loss is significant especially if bilateral, lasts longer than 3 months, or if the child already has cognitive, speech and language delay. It can delay speech and language acquisition, alter behavior, result in erosion of ossicles, impair the ear drum integrity, increase the risk of cholesteatomas and negatively impact the quality of life.

Candidates for myringotomy and Grommet insertion (M&G) include children with OME lasting 4 months or longer with persistent hearing loss or other signs and symptoms, recurrent or persistent OME in children at risk regardless of hearing status, and OME with structural damage to the tympanic membrane or middle ear³.

Grommet tube (GT) insertion results in a mean of 62% relative decrease in effusion prevalence and an absolute decrease of 128 effusion days per child during the following year⁴. The hearing level improves by 6 to 12 dB when tubes are patent. Approximately 20% to 50% of children have OME relapses after tube extrusion that may require repeat surgery. Adenoidectomy is recommended for those who require repeat surgery, unless contraindicated, because it gives 50% reduction of repeat operation⁵. The benefit of adenoidectomy is apparent at 2 years old,⁶ greatest for 3 years old or older and it is independent of adenoid size. Tympanostomy tube sequelae are common⁷. It can be transient such as otorrhea or does not affect function such as tympanosclerosis, focal atrophy or shallow retraction pocket. Tympanic membrane perforations are seen in 2% of children with short term ventilation tube and 17% of children with long term tube⁷.

There is a paucity of reports on outcomes of grommet insertion in South East Asia. Tanpowpong K et al reported 23 children with OME in Thailand whose hearing improved significantly after grommet insertion.⁸ The purpose of this study was to determine the patient profile of children needing grommet insertion and to determine if grommet insertion is safe and effective. Specific objectives were to look for the common presenting complaints, hearing level post M&G, associated risk factor for OME, complication with GT insertion and the academic performance pre and post GT.

MATERIALS AND METHODS

A retrospective review of all children with myringotomy and GT insertions for chronic OME between January 2006 and December 2008 at the National University Hospital, Singapore was undertaken. Chronic OME is defined as OME that persist longer than 3 months³. A patient was offered grommet insertion if they had failed conservative or medical treatment for 3 months, possibly earlier if there was an associated syndrome with a poor prognosis, and if hearing loss was significant, especially if it appeared to be impairing speech, language and academic performance.

Patient data on demographic profile, presenting complaints, indications, medical history, ear examination, hearing threshold and tympanometry evaluations, and complications of grommet insertion were collected. A telephone survey of parents was performed with questions on whether the parents felt that the hearing loss associated with the OME had adversely impacted school performance prior to GT, and if school performance in such cases have improved after GT

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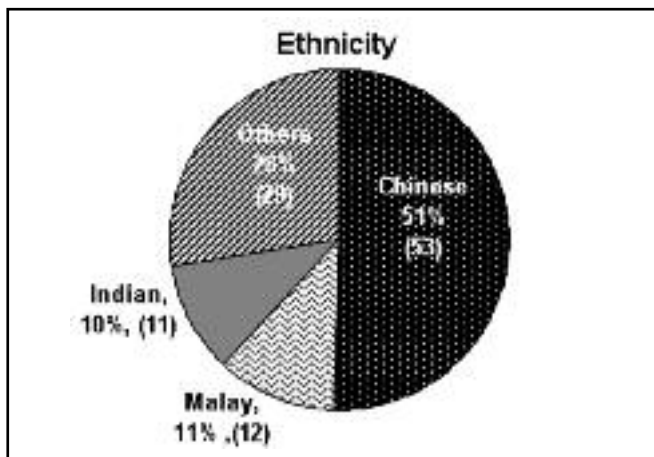


Fig. 1: Ethnic distributions of children with Grommet insertion for OME.

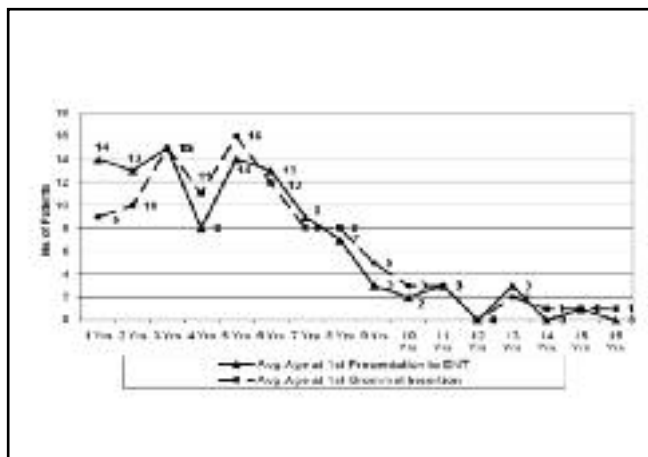


Fig. 2: The age of patients when first presented to ENT and age of first grommet inserted.

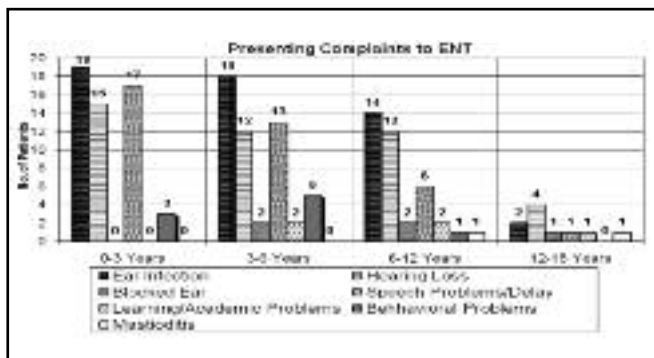


Fig. 3: Presenting complaints at different age group.

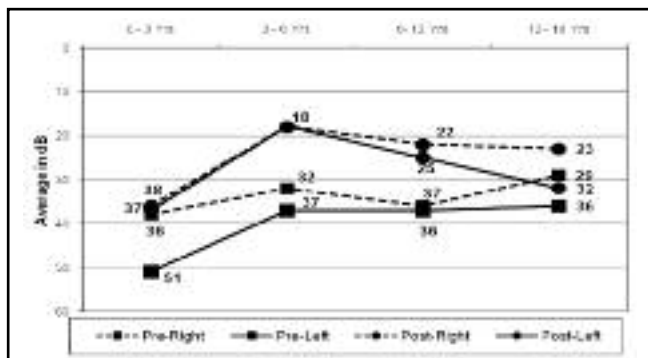


Fig. 4: Hearing level on the left and right before and after surgery.

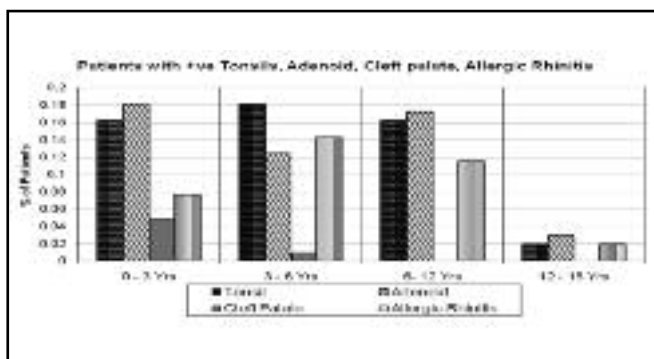


Fig. 5: The relationship between the tonsil hypertrophy, adenoid hypertrophy, cleft palate and allergic rhinitis to different age group.

insertion. Results were analyzed using SPSS. A p value of <0.05 was taken as significant. T-Test/Binomial/Chi-square was done to identify risk factors.

RESULTS

Patient Profile

There were 105 patients who had their first GT inserted between January 2006 and December 2008. There were 60 males and 45 females, ages between 3 months to 15 years.

Twelve percent (n=13) of patients were Syndromic; amongst them, 50% (n=6) had Down Syndrome. There were 2 chromosome deletions, one Larsen, one Hurler, one Moebius, one Vater and one obesity hypoventilation syndromes. Other significant medical histories were developmental delay (6), global development delay (8), cerebral palsy (2), intellectual disability (3), epilepsy (3), autism (3) and absent corpus callosum (1).

The ethnic distribution of Chinese: Malay: Indian: Caucasians and Others was 51%: 11%: 10%: 28%. The ethnic population in Singapore in 2009 of Chinese: Malay: Indian: Caucasians and Others was 72.4% : 13.4% : 9.2% : 3.2% (Fig. 1).

Seventy two percent (n=76) of the subjects were below 6 years old (range 1 month to 15 years). The graph shows that OME occur mostly between 1 to 6 years old. Only 30% of children had their first GT inserted after 6 years of age (Fig. 2).

Presenting Complaint

The patients were divided by age into 4 groups for study analysis. The groups were below 3 years old, preschool (3-<6years old), primary school (6-12 years old) and secondary school (12-18 years old). The leading presenting complaints were ear infection (50%), hearing loss (46%) and speech delay/problem (35%) which was seen at below 12 years old. Delayed speech in children was diagnosed when there's no speech was noted by 2 years of age. Hearing loss went hand

in hand with speech delay and was seen below 6 years old. Behavioral problems were noted in 9% of patients, mainly in the group 3 to 6 years old. Behavioral problems were diagnosed by history from parents or referral from a pediatric unit. Learning problems were seen in 5% of patients aged 3 and above. Two patients had mastoiditis at presentation (Fig. 3).

Hearing Profile

The hearing thresholds were determined by age-appropriate hearing tests with pure tone audiogram, play audiometry or auditory brainstem evoked response. Hearing pre- and post-grommet insertion showed improvement in all frequencies for all 4 age groups. The average pre-grommet hearing on the right was 34.4dB +/- 0.9 and 36.1dB +/- 4.3 on the left. The average post grommet hearing was 23.5dB +/- 10 on the right and 24.6dB +/- 6.8 on the left. The improvement was 32% on both side which is statistically significant ($p < 0.05$) (Fig. 4).

Tympanometry was used to assess the middle ear compliance. During the consultation prior to the grommet surgery, Type B tympanometry was noted in 74%, type A in 14% and type C in 12 % of patients with chronic OME requiring GT. The indication for M&G in type A is secondary to recurrent OME and type C is due to eustachian tube dysfunction.

Risk Factors for Otitis Media with Effusion Requiring Grommets

Fifty two percent of children had tonsil hypertrophy, 50 % had adenoid hypertrophy, 35% had allergic rhinitis, and 5% had cleft palate (repaired). Allergic rhinitis showed an increasing trend from group below 3 and preschool however a reducing trend from primary and secondary school children. For the entire cohort, allergic rhinitis and cleft palate were significantly associated ($p < 0.05$) with OME. Tonsil and adenoid hypertrophy were common among children in the 3 groups under 12 years old, however they were not significantly associated with OME. Associated abnormalities under 1 year old in this study were cleft palate (3), Down Syndrome (1), gastroesophageal reflux (1) and adenoid hypertrophy (3).

Bacteriology

Bacteriology cultures were not routinely done during grommet insertions at our centre. Middle ear fluid was sent for culture in only 12 patients, depending on the physician's personal mode of practice. This was more often done if the fluid appeared purulent at GT insertion. Staphylococcus aureus was cultured in 4 patients, Streptococcus Pneumonia in 3 patients, Streptococcus Pyogenes (Group A) in 2 patients, Pseudomonas Aeruginosa in 2 patients, and Enterobacter Cloaca in 1 patient. Most patients already had repeated courses of antibiotics.

Complications of Grommet Insertion

Fourteen percent of patients ($n=15$) needed repeated GT insertion. Amongst these 15 patients, 12 required a second surgery, and one each required a 3rd, 4th and 5th GT. Syndromic patients required significantly more repeat of GT, with 46% of Syndromic patients compared to 10% of non-Syndromic patients ($p < 0.05$). Complications were seen in 20 patients (19%). These included chronic ear discharge (10%), tympanic membrane perforation (5%), blocked grommet tube (2%), granulation tissue reactionary growth (1%) and

mastoiditis (1%) of patients. These complication rates were higher in syndromic patients compared to non-syndromic patients, but did not reach significance.

Academic performance

A retrospective telephone call survey was undertaken to ask parents of the school-going children in the study (6 to 18 years old) about the child's academic performance pre and post GT. The questions asked include their seat in the class and their rank and grade in school. Of the 29 patients in this age group, 18 patients were contactable. For these 18 patients, 6 parents said that the child's academic performance was affected by the hearing impairment. Five of these 6 patients were noted by their parents to improve in academic performance after the GT.

DISCUSSION

Otitis media is highly prevalent in young children. At least 80% of children will have experienced one or more episodes of otitis media by the age of 3 years. The peak incidence of acute otitis media occurs during the second half of the first year of life⁹. The prevalence is highest in those aged 2 years or younger and sharply declines after 6 years of age. Consistent with this, our study showed that OME requiring grommet insertion occurred mostly in children under 6 years old (70%), and then declined with increasing age. OME can present as young as 1 month old. In infants, OME requiring GT usually occurs in patients with other anomalies like cleft palate or adenoid hypertrophy should first be excluded. Adenoid hypertrophy in a 1 year old is not common, and may be associated with laryngopharyngeal reflux. Associated abnormalities under 1 year old in this study were cleft palate, Down Syndrome, gastroesophageal reflux and adenoid hypertrophy.

The ethnic distribution of patients undergoing grommet insertions for OME at our centre corresponds to the distribution of ethnicity in Singapore, with the exception of a higher proportion of Caucasians and Others. Our male and female ratio of 4:3 is consistent with the literature reporting that males have a higher risk of OME.

Twelve percent of children in this study were syndromic, with Down Syndrome predominating (50%). This is likely because it is a relatively common syndrome, and Down children are comparatively well such that caregivers are more likely to address ear-related problems. Many syndromes have craniofacial abnormalities or muscular hypotonia which predispose to OME. Children with craniofacial anomalies like cleft palate, Down Syndrome, Robin sequence, CHARGE association have higher prevalence of chronic OME, hearing loss, and speech and language delay than normal children.

Forty six percent of our patients had hearing loss. Speech problem and delayed in speech is seen in 35% of our patients. Fourteen patients have both hearing loss and speech delay. In this study, pre and post grommet insertion hearing thresholds for both ears showed clinically significant improvements of 32%, 10.9 dB on the right and 11.5dB on the left respectively. The worst hearing was seen in children between 0 to 3 years old, which coincides with the time when hearing is crucial to speech and language acquisition. Children with greater

hearing loss at baseline appeared to benefit more from treatment with ventilation tubes than those with a smaller hearing loss¹¹.

Parents of 6 out of the 18 patients of school-going age who were interviewed (33%) felt that their child's chronic OME had affected the child's academic performance problem. Common presenting complaints of OME are reduced hearing or blocked sensation, without pain.

Chronic or repeated OME related hearing loss can be mild to moderate, which can result in speech, language and behavioral changes. This is significant especially for young children who are still acquiring speech and language and schooling. If hearing loss is chronic, grommets are advised. Candidates for surgery include children with OME lasted 4 months or longer with persistent hearing loss or other signs and symptoms, recurrent or persistent OME in children at risk regardless of hearing status, and OME with structural damage to the tympanic membrane or middle ear³. Many consonants of speech require near perfect hearing at 20dB to be heard, especially in noisy environments like the classrooms. Roberts et al found that there is a significant relationship between a history of early OME from 6 months to 2 years of age and lower expressive language scores and math at the younger ages, but the relationship was no longer significant by second grade and the child's home environment was more strongly related to language and academic outcome³. More of such studies are warranted.

Behavioral problem was seen in 9% of our patients, especially those between 3 to 6 years old. Two older children had mastoiditis which required mastoidectomy and grommet surgery. Mastoiditis and cholesteatoma are known complications of OME.

Type B tympanometry was noted in 74%, type A in 14% and type C in 12 % of patients with chronic OME requiring GT. Tympanometry can be normal type A in between episodes of recurrent OME. Type C tympanogram suggests negative middle ear pressure due to eustachian tube dysfunction.

Fifty per cent of our patients had adenotonsillar hypertrophy. Chronic adenoid infection may act as a source of pathogens which can spread to the middle ear via the Eustachian tube¹². Studies have shown higher rates of nasopharyngeal carriage of pathogenic bacteria in patients with OME than controls. The presence of laterally placed adenoid tissue around the torus tubarius is associated with OME, but not the absolute size of the adenoid.

Allergic rhinitis in 35% was significantly associated with OME in this study. Allergic rhinitis causes nasal inflammation with impaired eustachian tube function. Hurst (2008) showed 85% of OME resolved completely on specific immunotherapy compared to none resolving spontaneously, suggesting OME is an immune mediated allergic disease¹³.

Complications were seen in 19% of our patients with GT. Chronic ear discharge accounted for 55% of the complications. Chronic ear discharge occurred in 3 of 5 patients needed repeated GT, and in all 4 syndromic patients. Eight of 37 patients with allergic rhinitis had complications. Five patients presented with ear discharge, 2 with blocked GT,

and one with granulation tissue. Allergic rhinitis is associated with inferior turbinates hypertrophy and more frequent and persistent nasal infections with retrograde OME via the Eustachian tubes. Residual tympanic membrane perforations were seen in 5 patients, with only 2 of these patients having repeated grommet insertion. The perforation rate was not associated with any specific type of grommet tube. Blocked GT and granulation reaction were uncommon.

CONCLUSION

Most of our children needing grommet insertion for chronic OME were less than 6 years old. There was a higher proportion of Caucasians compared to the ethnicity distribution in Singapore. The leading presenting complaints were hearing loss and speech delay. Allergic rhinitis and cleft palate were associated with OME, but not adenoid nor tonsil size. Thirty three percent of parents of school going children in this study felt that the child's academic performance was impaired by the chronic OME. Hearing thresholds improved significantly after grommet insertion. Grommet insertion is safe, but syndromic patients had more grommet associated problems and repeated grommet insertion.

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