

NOVA AUD UK

AUD 7130

Paediatric Audiology

Final Paper

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1<sup>st</sup> May 2020

## **A review of current recommendations in the management of Otitis Media with Effusion (OME) in children.**

### **Introduction**

Otitis media with effusion (OME), commonly known as 'glue ear' is a very common condition in childhood characterised by fluid (mucous) behind the eardrum, in the middle ear space, without an ear infection. It is the most common cause of temporary conductive hearing loss in children, which can lead to delayed speech and language development, poor performance at school, behavioural problems and other issues, which will be discussed in this review. OME is a very common finding in children presenting in ENT and Audiology clinics. Although guidance on the management of OME in children has been published in the UK by NICE the National Institute for Health and Care Excellence (2008), it is this author's experience that management of OME can vary considerably depending on the clinician managing the case or on the clinical setting for example private practice setting versus NHS hospital setting. It is therefore the purpose of this paper to review the current guidance on the management of OME in children from both the NICE guidelines and the American Academy of Otolaryngology and Head and Neck Surgery (AAOHNS) guidance (Rosenfeld et al, 2016), as well as systematic reviews and other studies in order to advise audiologists working locally in every day clinical practice, on the most recent evidence based recommendations to give to parents and care givers of children with confirmed OME.

## **Background**

OME occurs commonly in children between the ages of 6 months up to about 8 years. It can occur following upper respiratory tract infection which leads to eustachian tube dysfunction. It quite often resolves itself, however if OME persists for more than 3 months it is termed chronic OME.

Children are more prone to OME because the eustachian tube has not been fully developed. In an adult the eustachian tube, which is a tube linking the middle ear space to the nasopharynx behind the nose, is at an angle of about 45°. The purpose of the eustachian is to ventilate the middle ear and allow pressure equalisation in the middle ear space.

Following an upper respiratory tract infection or cold, the eustachian tube may become inflamed or the mucous lining may become 'sticky'. This means the eustachian tube cannot open as effectively and therefore cannot ventilate the middle ear to equalise the pressure as effectively. In children the eustachian tube is in more of a horizontal alignment and the cartilage is 'floppier'. Therefore, in children the eustachian tube is more prone to dysfunction.

When the middle ear is not ventilated properly, this leads to negative pressure in the middle ear space, which in turn causes retraction of the eardrum and fluid, drawn from the surrounding tissue, to build up in the middle ear space, hence causing OME.

The fluid in OME is sterile. If there is a bacterial infection present in the fluid this is termed Acute Otitis Media (AOM) and is usually rapid onset, accompanied by pain and fever. In addition, the fluid in AOM is yellow and usually causes a bulge of the ear drum, both of which can be viewed by otoscopy. OME on the other hand, can be viewed as clear fluid with bubbles present. Both OME and AOM can be termed as Middle Ear Effusion or MEE.

## **Prevalence**

According to Casselbrant et al, (2003), more than 50% of children will experience OME by the age of one year and this increases to more than 60% by the age of two

years. Hogan et al, (1997), reported that 20% of children in the UK had either unilateral or bilateral OME for a total of more than 18 months during their first three years of life. The prevalence then decreases with age. In a study by Martines et al (2010) school aged children were screened for OME and the prevalence in five to six year olds was 12.5%.

In most cases OME resolves spontaneously within 3 months, although 50% of those who have had an episode will go on to have further episodes (Zielhuis et al, 1990). A higher prevalence of OME is seen in children with Down Syndrome or cleft palate, ranging from 60% to 85% (Flynn et al, 2009., Maris et al, 2014.)

### **Diagnosis**

OME is first suspected when parents, care givers or teachers raise concerns regarding hearing loss, inattention, poor listening at school or nursery and or behavioural problems, as well as recurrent ear infections or otalgia. NICE guidelines recommend the clinician take a detailed clinical history with particular attention focussed on these concerns followed by medical examination including otoscopy, hearing tests carried out by an audiologist and tympanometry.

The diagnosis of OME is usually confirmed by the results of Otoscopy and tympanometry. If a flat type B or shallow type A<sub>s</sub> tympanogram with a normal ear canal volume is obtained, this is indicative of OME, as the fluid in the middle ear is impeding the movement of the eardrum and hence zero or reduced compliance is seen on the tympanogram.

The guidance from AAOHNS (Rosenfeld et al, 2016), strongly recommends the use of pneumatic otoscopy, which involves forming a seal between the specula on the otoscope and the ear canal and then changing the pressure in the ear canal by gently squeezing and releasing a pneumatic bulb which has been attached to the otoscope. As well as visually observing the presence of fluid or bubbles behind the ear drum (or yellow fluid in the case of AOM), the clinician can observe the movement of the ear drum with the pressure changes. Lack of movement indicates the presence of middle ear fluid, which confirms the diagnosis of OME. The guidance

also strongly recommends tympanometry, however only if pneumatic otoscopy is inconclusive or unsuccessful.

Furthermore, the AAOHNS guidance does not recommend a hearing test be performed as a routine part of the diagnostic process for children suspected with OME as the NICE guidelines do. Rather, after OME has been confirmed with pneumatic otoscopy or tympanometry they recommend a period of watchful waiting for 3 months in otherwise healthy children. Only if OME persists after 3 months is a full hearing test then recommended.

### **Consequences of OME**

Fluid in the middle ear space can impede transmission of sound through the conductive part of the auditory pathway into the inner ear. The level of conductive hearing loss can vary from normal hearing up to a moderate loss. Most cases of OME resolve spontaneously within three months and therefore have no lasting effects. However, in cases of chronic or recurrent OME, the fluctuating or persistent loss of hearing can have an impact on speech and language development, learning, listening skills, attention, behaviour, social interactions and quality of life. OME has also been reported to cause balance problems. The impact of OME on a child will depend on many factors including age, pre-disposing medical conditions such as Down syndrome or cleft palate, the child's level of speech and language development, cognitive abilities and home environment.

The AAOHNS guidance defines a list of conditions that would predispose children to greater difficulties resulting from OME, as follows "Permanent hearing loss independent of OME, suspected or confirmed speech and language delay or disorder, Autism spectrum disorder and other pervasive developmental disorders, syndromes (eg Down) or craniofacial disorders that include cognitive, speech or language delays, blindness or uncorrectable visual impairment, cleft palate, developmental delay" (Rosenfeld et al., 2016 pS5).

Other risk factors for developing OME include passive smoking and attending day care (Todberg et al, 2014), recurrent ear infections or episodes of AOM and frequent

upper respiratory tract infections. Genetic inheritance can also play a part up to five years of age (Casselbrant et al, 2004).

### **Hearing Loss**

The level of hearing loss caused by OME and whether it is unilateral or bilateral will have a significant influence on the management, as well as considering other risk factors. The range of hearing levels in children with OME goes from normal hearing up to 55dB (Sabo et al, 2003), with an average hearing loss of 28dB and a loss of more than 35dB found in 20% of children. (Hunter et al, 1994).

NICE guidelines (2008) recommend surgical intervention with ventilation tubes (also called grommets or tympanostomy tubes) for children with bilateral persistent OME (over 3 months) with pure tone average hearing thresholds in the better ear worse than 25-30 dB HL for 0.5, 1, 2 and 4kHz. The AAOHNS guidance does not specify a level of hearing loss above which to recommend intervention but does also recommend that the OME should be persistent for over 3 months before intervention is considered, other than in children in the 'at risk' group.

Both the NICE and AAOHNS guidance only considers bilateral OME as appropriate for surgical intervention, with grommets (tympanostomy tubes). If a child has a unilateral hearing loss as a result from unilateral OME, then the effects would be the same as any unilateral hearing loss, which is difficulty in sound localisation and difficulty hearing speech in background noise, which can affect them in an educational setting. Therefore, one could argue that if the guidance is followed then potentially children with unilateral hearing loss caused by OME could be left untreated and at a significant disadvantage, with regards to speech and language development as well as academic progress.

Reduced hearing leads to increased effort to de-code speech signals, especially when there is competing background noise. Adults with hearing loss use working memory, context, body language and facial expressions to 'fill in the gaps', in order to compensate for loss of audibility, spectral and temporal cues. Children do not have the same experience to draw upon and are therefore unable to compensate in

the same way. This increased listening effort leads to fatigue, inattention and lack of processing ability available for other cognitive functions such as learning or performing tasks. In addition, as hearing loss caused by OME is fluctuating the brain can find it difficult to adapt. Hearing loss caused by chronic or recurrent OME can lead to behavioural problems caused by frustration and fatigue because of the increased listening effort.

### **Impact of OME on speech and language development**

The effect of OME on speech and language development will be dependent on many interacting factors such as, age at onset of OME, number of episodes, duration of OME, unilateral or bilateral, degree of hearing loss, home environment as well as other conditions as defined by the at risk group listed in the AAOHNS guidance (Rosenfeld et al, 2016). When assessing the impact of OME on speech and language development, both expressive and receptive language need to be considered.

A systematic review by Shekelle et al, (2003), found no evidence of any effect of episodes of OME before the age of three, on any subsequent expressive or receptive language development. Rosenfeld et al, (2016) point out that this report should be interpreted with caution as the study was looking at the relationship of OME to language development and not the relationship between hearing loss associated with OME, and language delay.

Hall et al, (2007) conducted a longitudinal study with one thousand children to look into the relationship between OME and Word Recognition Thresholds (WRT) between the ages of 2 to 5 years. WRT's and OME status measured by tympanometry, was recorded at 31, 43 and 61 months of age. They found an average increase of 5dB in WRT when unilateral OME was present and an increase of 15dB WRT with bilateral OME present, compared to normal hearing and no OME, between the ages of 31 and 61 months. Additionally, they found that if a child had recorded bilateral flat tympanograms at 31 months then the WRT's were elevated by 8dB and 5dB when tested at 43 and 61 months respectively. They conclude that early and persistent OME leads to a significant disability in relation to word recognition.

### **Relationship between OME and attention**

Hooper et al (2006), conducted a longitudinal study with 74 children to look at the relationship between OME, hearing loss and attention. The children's hearing and middle ear status were tested between the ages of 6 to 48 months, using pneumatic otoscopy, tympanometry and age appropriate hearing tests. They were also assessed for selective auditory attention, sustained attention and classroom engagement using various direct assessment tools, behavioural observation and teacher reports. The home environment was assessed annually using the "Home Observation for Measurement of the Environment (HOME)" (Elardo et al, 1981, p113), which is a questionnaire that measures the amount of cognitive support the child receives at home by exploring things such as whether the mother reads to the child and the type of toys the child has access to. Socioeconomic status and level of parental education were also taken into account.

The results of the study did not find any direct significant relationship between history of hearing loss and OME, and the different dimensions of attention. However, they did find a significant link between socioeconomic status and HOME scores, and reduced scores in attention with OME and hearing loss. They concluded that the impact of OME and hearing loss on attention is greater in children from lower socioeconomic backgrounds and with poorer cognitive support in the home environment.

### **Relationship between OME and IQ**

Hall et al (2014) conducted a longitudinal study to examine the relationship between episodes of OME and hearing loss, with IQ and interaction with socioeconomic factors. 1155 children between the ages of 8 months to 5 years were serially tested for OME using tympanometry, hearing was tested by measuring word recognition thresholds (WRT) from the ages of 2.5 years to 5 years and IQ was measured at age 4 and aged 8 years. Socioeconomic factors such as the educational level of the mother, housing tenure e.g. rented, privately owned or social housing and parental social class were all recorded. The HOME questionnaire was used to assess the level of cognitive support they received at home. They found that those children with the highest incidence of OME and hearing loss had a performance IQ 5 points lower at aged 4 than children with no OME or hearing loss. However, the difference

became insignificant by the age of 8. There was a significant relationship between OME and hearing loss, IQ and HOME scores. Children with a high incidence of OME and hearing loss and low HOME scores had significantly lower IQ scores than children with high incidence of OME and hearing loss and high HOME scores at age 4 and 8 years. Therefore the children with lower HOME scores, that is with less cognitive input at home, had more susceptibility to the effects of OME and hearing loss on IQ.

### **Management options in children with OME**

#### **1. Watchful waiting**

Both the NICE guidelines and the AAOHNS guidelines strongly recommend a period of 3 months of watchful waiting, as the majority of cases in otherwise healthy children will resolve spontaneously within this time period. The purpose of watchful waiting is to avoid unnecessary appointments, investigations, interventions and surgery (Rosenfeld et al 2016).

It is recommended that clinicians should give advice to parents and care givers on the potential effects of OME and hearing loss, whilst waiting for the resolution of the condition. This advice should include education on levels of hearing loss and what the child can and cannot hear with a given level of loss. The audiogram of everyday sounds can be used to explain this. Listening tactics to support the child such as speaking in close proximity to the child, facing the child, enunciating clearly and slowly and providing classroom seating closer to the teacher, should be discussed. (Merenstein et al, 2005).

Where the AAOHNS and NICE guidance differ is the recommendation of having formal hearing tests in children with suspected OME. NICE guidance recommends performing a hearing test and tympanometry on all children with suspected OME, whereas the AAOHNS guidance recommends a hearing test only when OME has been confirmed using pneumatic otoscopy or tympanometry and following a 3-month period of watchful waiting, if the OME is persistent.

It may be more beneficial to have actual hearing test results at the outset, if the clinician is advising a 3-month period of watchful waiting, so that the parents can be



better informed on the extent of the loss and the potential effects of the loss during the period of watchful waiting.

NICE guidance also states that “Auto-inflation may be considered during the active observation period for children with OME who are likely to cooperate with the procedure” (NICE, 2008, p.28)

Watchful waiting is not recommended for children who are at risk of greater adverse or long-term effects of recurrent OME and hearing loss such as Down syndrome and cleft palate children and those in the at risk group defined in the AAOHNS guidance.

## 2. Medical treatment

It is strongly advised not to use steroids, antibiotics or antihistamines in the treatment of OME by both NICE and AAOHNS. The evidence in the literature shows no significant benefit in the use of these medications in the treatment of OME, or improvement of hearing levels. (Browning et al, 2010)

## 3. Alternative therapies

Alternative therapies such as homeopathy, cranial osteopathy, acupuncture and dietary modifications are also not recommended in the treatment of OME (NICE guidelines, 2008). There is insufficient evidence to support the recommendation of alternative therapies to treat OME (Rosenfeld et al, 2016).

## 4. Surgical intervention

The NICE guidelines recommend surgical intervention with grommets (tympanostomy tubes), in cases of chronic, persistent, bilateral OME with a hearing loss of 25-30dB in the better hearing ear, averaged over 0.5, 1, 2 and 4kHz. The AAOHNS guidelines also recommend the insertion of grommets in cases of chronic OME, but do not specify a level of hearing loss as a cut off to proceed.

Quite often adenoidectomy is performed at the same time as grommet insertion. Neither AAOHNS guidelines or NICE guidelines recommend adenoidectomy is performed with grommet insertion unless there is a defined clinical need such as upper respiratory tract symptoms, nasal obstruction or chronic adenoiditis as there is

limited evidence that this is of any clinically significant benefit (Rosenfeld et al 2016). The AAOHNS guidance does go on to specify however, that adenoidectomy with grommet insertion should be recommended in OME children over the age of 4 years, as there is evidence from systematic reviews that performing adenoidectomy at the same time as grommet insertion in this group leads to fewer repeat incidences of OME and repeat surgery. (Rosenfeld et al, 2016).

Any decision to proceed with surgery for children with OME must be made collaboratively between the surgeon and parents or care givers of the child. The benefits and risks must be explained to them fully, so that they are able to make an informed decision to proceed with surgery. Although the procedure for grommet insertion is routine, it does involve anaesthesia, which does carry a level of risk and can cause parental anxiety. There is an increased risk of otorrhoea in younger children, less than 3 years old. There is also a risk of tympanosclerosis, particularly in repeat grommet insertions. (Browning et al, Cochrane review, 2010).

The Cochrane review of grommet insertion for children with OME conducted in 2010 by Browning et al, found that grommets have a beneficial effect on hearing, with a 12dB improvement at 3 months post insertion, compared with a control group with OME and no intervention. This effect became less with time, with a benefit of 4dB at 6 to 9 months and this diminished to no difference at 12 and 18 months. This confirms the tendency for OME to spontaneously resolve in the majority of cases. Furthermore, they did not find any effect of grommet insertion on long term speech and language development, behavioural and cognitive measures or measures of quality of life.

## 5. Hearing aids

Hearing aids can be offered to children with persistent and chronic OME and hearing loss, as an alternative to insertion of grommets. This is recommended in the NICE guidelines for children with Down Syndrome as they will be more prone to recurrent and longer lasting episodes of OME.

Hearing aids can also be considered as an option when a child has had multiple surgeries for grommet insertion as this can lead to scarring of the tympanic membrane and retraction pockets.

Hearing aids can be considered in the watchful waiting phase or when surgery is contraindicated. Bone conduction hearing aids can be used for children with OME and cranio-facial abnormalities. The downsides to hearing aid use for OME are the significant financial cost to resolve a temporary condition and possible lack of compliance from the child.

### **Conclusion / summary**

OME or 'glue ear' is a very common condition of childhood. Most cases will resolve themselves and most children will have at least one episode in their early years. Intervention is not usually needed unless there are repeated or prolonged episodes of OME, termed chronic OME.

Current best practice is to confirm diagnosis of OME using a clinical history, Otoscopy / pneumatic otoscopy, a full hearing test and tympanometry. It is usual practice to recommend watchful waiting for a period of 3 months from diagnosis or from the date of onset, if known. The possible negative effects of recurrent and persistent OME and hearing loss are speech and language delay, poor attentiveness, reduced academic performance and behavioural problems. Studies show that the most effective treatment is grommet (tympanostomy tube) insertion and this will improve hearing immediately. There are however, no long term effects of OME on speech and language development as the plasticity in a child's brain allows for adaptation following a period of auditory deprivation.

Careful consideration needs to be given to certain populations such as children with Down syndrome, existing permanent sensorineural hearing loss, developmental or cognitive delay and autism spectrum disorder. These children will be at greater risk from the negative consequences of OME and watchful waiting is not recommended for children in these groups. If OME is found then grommet insertion should be considered immediately or the child should be tested every 3 to 6 months. Children

from poorer socioeconomic backgrounds and those with less parental cognitive support at home are also more at risk of the negative effects of recurrent glue ear.

Ultimately, the decision of whether to intervene in OME, using grommets needs to be a collaborative decision between clinicians and parents or care givers and will depend on the level of hearing loss and the possible short and long term effects on the quality of life of the child. The clinician must use their professional judgement when deciding at what point surgical intervention is recommended, based on the individual case and current best practice guidelines.

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