

# Grommets - an update on common indications for tympanostomy tube placement

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## Introduction

Children younger than 7 years are at increased risk of otitis media because of their immature immune systems and poorly functioning eustachian tubes that normally ventilate the middle ear space and equalize pressure with the external environment. More than 80% of children have at least one episode of acute otitis media (AOM) before the age of 3 years and 40% experience six or more recurrences by the time they are 7 years old.<sup>1</sup> By the age of 3 years, approximately 7% of children undergo surgery for tympanostomy tube insertion for a range of otitis media issues, most commonly for chronic otitis media with effusion (OME), recurrent acute AOM, and acute otitis media that persists despite antibiotic therapy.<sup>2</sup> However, tympanostomy tube insertion is associated with risks, and remains a controversial practice especially in children with OME of less than three months' duration and in children with recurrent AOM. Adverse effects associated with tympanostomy tube insertion include those associated with anaesthesia and its complications (laryngospasm, bronchospasm) as well as tube related sequelae such as recurrent (7%) or persistent (16-26%) otorrhoea, blockage of the tube lumen (7%), granulation tissue (4%), premature extrusion of the tube (4%), tympanostomy tube displacement into the middle ear (0.5%) and persistent perforation of the tympanic membrane (1%-6%).<sup>3</sup> This article offers guidance for Family Practitioners wishing to optimize health outcomes in children potentially requiring tympanostomy tube placement.

**Table I:** Abbreviations

AOM	Acute otitis media
OME	Otitis media with effusion
MEE	Middle ear effusion
TTO	Tympanostomy tube otorrhoea

## Otitis media with effusion (OME) of short duration

Otitis media with effusion (OME) is defined as middle-ear effusion (MEE) without acute signs of infection.<sup>4</sup> (Figure 1) It is common; 90% of children have OME before school age, experiencing, on average, 4 episodes of OME per year.<sup>5</sup> The prevalence of OME in children with Down syndrome or cleft palate is much higher. It is frequently asymptomatic and therefore often remains undetected. It is strongly recommended that pneumatic otoscopy is used to assess for OME in children with otalgia, hearing loss or both.<sup>5</sup>

OME mostly occurs after acute otitis media (AOM) with a prevalence of 70% at 2 weeks, 40% at 1 month, 20% at 2 months and 10% at 3 months post infection.<sup>6</sup> OME may also occur with eustachian tube obstruction in the absence of AOM.<sup>4</sup> A recent meta-analysis suggests that allergic rhinitis and allergy may be risk factors for OME.<sup>7</sup>

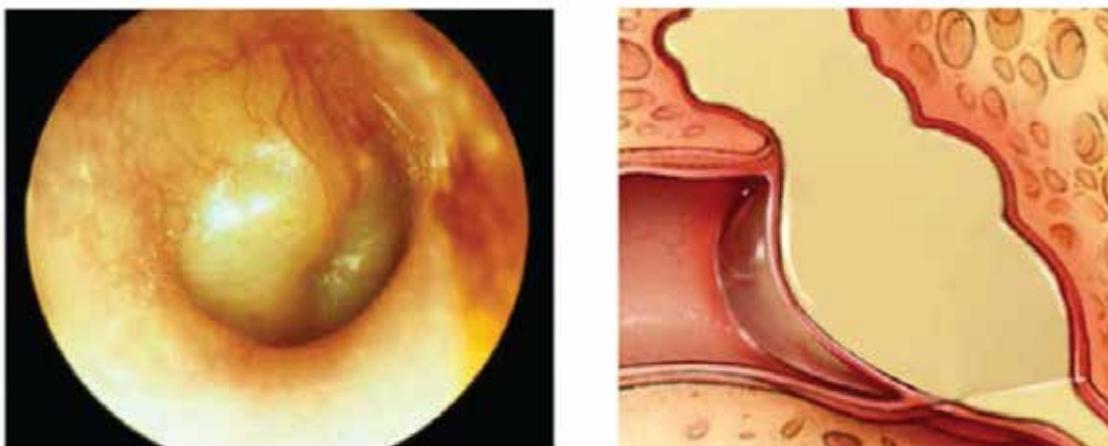
There is strong evidence *against* the insertion of tympanostomy tubes in children experiencing a single episode of OME of less than 3 months' duration because of the likelihood of spontaneous resolution in this instance as well as the risks associated with unnecessary surgery.<sup>3,6</sup> Rather, watchful waiting for 3 months following the onset of effusion / diagnosis is strongly recommended.<sup>5</sup>

Early surgical referral is, however, indicated for children who are at risk for developmental delays where hearing is critical for their speech, language and learning development, irrespective of the duration of OME;<sup>8</sup> Hearing loss related to OME averages 18–35 dB.<sup>9</sup> Risk factors for developmental difficulties include permanent hearing loss independent of OME, suspected or confirmed speech and language delay, autism and other pervasive developmental disorders, syndromes or cranio-facial disorders that include cognitive, speech or language delays, blindness, cleft palate or any other cause of developmental delay.<sup>3,4</sup>

### Otitis Media with Effusion (ear fluid)



### Acute Otitis Media (ear infection)



**Figure 1:** Comparison of otitis media with effusion (top) and acute otitis media (bottom). The left images show the appearance of the eardrum on otoscopy, and the right images depict the middle ear space. For otitis media with effusion, the middle ear space is filled with mucus or liquid (top right). For acute otitis media, the middle ear space is filled with pus, and the pressure causes the eardrum to bulge outward (bottom right). With permission from Rosenfeld 2016<sup>5</sup>

### Chronic otitis media with effusion (OME)

Once OME has persisted in both ears for 3 months or longer, spontaneous resolution is unlikely: only 20% of these resolve within 3 months, 25% after 6 months and 30% after a year of observation.<sup>6</sup> Chronic middle ear fluid results in decreased mobility of the tympanic membrane and may be associated with hearing loss, balance (vestibular) problems, poor school performance, behavioural problems, ear discomfort, recurrent AOM, or reduced quality of life.<sup>3</sup> Other rarer complications of OME include structural damage to the tympanic membrane that requires surgical intervention.<sup>5</sup>

Age-appropriate hearing testing is therefore recommended if OME persists for 3 months or longer. Children with bilateral chronic OME associated with documented hearing difficulties may be offered bilateral tympanostomy tube insertion. In chronic OME sufferers the benefits of tympanostomy tubes include a 30% reduction of middle ear

effusion (MEE) with an associated 5 to 12 dB improvement in hearing in the first 6 to 9 months after tube insertion.<sup>10</sup> Although quality of life improvements for both the child and the caregiver are considerable,<sup>2</sup> there is little evidence that optimized auditory access has a significant impact on speech, language or cognitive outcomes in children not at risk for developmental delays.<sup>3</sup> There is some consensus that a hearing loss exceeding 39 dB probably warrants surgery, but shared decision making with caregivers is strongly advised in all cases.<sup>4</sup>

Alternatives to tympanostomy tube insertion are limited to surveillance. The latest guidelines emphasise that clinicians should recommend *against* using intranasal or systemic steroids, systemic antibiotics, antihistamines or decongestants for treating OME.<sup>2-5</sup>

## Chronic OME with other symptoms

Children who have either unilateral or bilateral chronic OME with symptoms that are likely attributable to OME may also be offered tympanostomy tube insertion. Symptoms include vestibular problems (clumsiness, balance problems, delayed motor development), poor school performance, behavioural problems, ear discomfort or poor quality of life. Although OME has a direct and reversible effect on the vestibular system,<sup>11</sup> it must be noted that the causes of all of the above symptoms may be multifactorial, and once again, shared decision making with caretakers is critical and should be based on realistic expectations about how the reduction in MEE may improve the child's health. Quality of life indicators such as physical symptoms, caregiver concerns, emotional distress, hearing loss and speech impairment may improve significantly after tympanostomy tube insertion.<sup>3,12</sup>

## Surveillance of chronic OME

Children with chronic OME who do not have tympanostomy tubes should be re-evaluated at 3 to 6 month intervals with pneumatic otoscopy, developmental surveillance and hearing testing until the effusion resolves, significant hearing loss (> 39 dB) is detected or structural abnormalities of the tympanic membrane (local inflammatory response, focal retraction pockets, generalised adhesive atelectasis,) or middle ear (cholesteatoma, ossicular erosion) are suspected. Although uncommon, suspected tympanic membrane abnormalities should prompt specialist referral.<sup>3,5</sup>

## Recurrent acute otitis media (AOM)

Tympanostomy tube insertion is *not* indicated in children with recurrent AOM who do not have MEE in either ear because of the favourable natural history of this condition and good evidence that these children do not have a reduced incidence of AOM after tympanostomy tube insertion.<sup>2</sup>

This contrasts with children who have recurrent AOM associated with unilateral or bilateral MEE who may be offered bilateral tympanostomy tube insertion. Persistent MEE may be an indicator of underlying eustachian tube dysfunction that may possibly predispose to future AOM recurrence. The other potential benefits of tympanostomy tube insertion are that future episodes may be treated with topical antibiotics rather than systemic, and may be associated with less pain and hearing loss. Once again, the possible benefits of surgery need to be weighed against the risks, and caregivers should be involved in the decision-making process. Surveillance may be offered if there is uncertainty.<sup>3</sup>

## Persistent or severe acute otitis media (AOM)

Although no trials have been conducted in this difficult-to-enrol patient group, increasing problems with bacterial resistance have paved the way for tympanostomy tube placement in children with persistent or severe AOM. This

allows drainage of secretions, facilitates culture of infective organisms and provides a direct route for delivering antibiotic eardrops to the middle ear. In addition, when children with tympanostomy tubes continue to experience AOM episodes, they may be managed with topical antibiotic eardrops rather than with systemic therapy.<sup>3</sup> Noteworthy is that chronic suppurative otitis media is a major cause of hearing impairment in many developing countries.<sup>1</sup>

## Post-operative care

Tympanostomy tubes usually remain in place for 12 to 14 months. During this period, children should be followed up routinely by an ENT surgeon as well as by their primary care provider who should refer patients if the tympanostomy tubes cannot be visualised or are occluded, if there are concerns about changes in hearing or if other complications such as granuloma, persistent or recurrent otorrhoea, perforation of the tube site, persistent tube for longer than 2-3 years, retraction pocket or cholesteatoma are identified. The ultimate goal is for the tubes to remain in place until children have outgrown their middle ear disease.<sup>3</sup>

Approximately 15%-26% of children with tympanostomy tubes will have additional episodes of AOM, and otorrhoea is typically their only symptom.<sup>3</sup> Uncomplicated (temperature < 38.5°C, no concurrent illness requiring systemic antibiotics, no cellulitis extending beyond the external ear canal) acute (less than 4 weeks duration) tympanostomy tube otorrhoea (TTO) usually caused by typical nasopharyngeal pathogens (*S pneumoniae*, *H influenzae*, *M catarrhalis*) and/or external auditory canal pathogens (*P aeruginosa*, *S aureus*) responds to topical antibiotic ear drops such as ciprofloxacin, ofloxacin or ciprofloxacin-dexamethasone, and benefits from water precautions until the discharge resolves.<sup>3</sup> The advantages of topical rather than systemic antibiotics are multiple and include higher tissue levels, reduced adverse effects and less likelihood of the development of antimicrobial resistance.<sup>13</sup> Only eardrops specifically approved for use with tympanostomy tubes should be used because non-approved drugs, including over-the-counter preparations, are ototoxic and may induce pain or infection, or even damage hearing.

Routine prophylactic water precautions such as avoidance of water sports or the use of earplugs are not recommended, unless children are immuno-compromised, swim in heavily contaminated water, participate in deep diving or experience ear discomfort during swimming.<sup>3</sup>

## Conclusions

There is relatively strong evidence for tympanostomy tube insertion in children with chronic bilateral OME with associated significant hearing difficulties as well as in children with recurrent AOM with MEE. Tube insertion is optional but recommended in children at risk for speech, language or learning problems who have recurrent AOM or OME, and in children who have chronic OME with symptoms.

These recommendations should be implemented within a collaborative team approach to ensure developmental outcomes are not compromised.<sup>14</sup> When making clinical decisions, the risks of tube insertion must be balanced against the risks of prolonged or recurrent otitis media, which include suppurative complications, damage to the tympanic membrane, adverse effects of antibiotics, and potential developmental sequelae of hearing loss.

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