

**ENT: all you need to know about the surgical approach to the management of middle ear effusions in Australian Indigenous and non-Indigenous children.**

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**Abstract**

Otitis media is a common condition in Australia. It represents a spectrum of disease from otitis media with effusion (OME) to chronic suppurative otitis media (CSOM). For all the OM diagnoses, Australian Indigenous children have higher rates of early onset, severe, and persistent disease. OME is the commonest form of OM and often occurs after an upper respiratory tract infection. It can be difficult to diagnose (and often goes unrecognised). Hearing loss is the most important complication. The middle ear effusion impedes the movement of the tympanic membrane and causes a conductive hearing loss of around 25dB. Around 20% will have a hearing loss exceeding 35dB. Children with early onset, persistent, bilateral OME and hearing loss (or speech delay) are most likely to benefit from interventions. However, the impact of all the effective treatment options is modest. Giving advice about effective communication strategies for young children is always appropriate. The best evidence from randomised trials supports not using antihistamines and/or decongestants, considering a trial of antibiotics, and referral for tympanostomy tubes. Despite the availability of evidence-based

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guidelines, giving advice about treatment is a challenge because recommendations vary according to condition, age, risk of complications, and parental preference. While most children with OME can be effectively managed in primary care, we need to get children who meet the criteria for simple ENT procedures that improve hearing on to ENT surgery waiting lists. Long delays in hearing support may contribute to life-long social and economic disadvantage.

## Introduction

Otitis media (OM) is common in Australia.<sup>1 2</sup> It represents a spectrum of disease from otitis media with effusion (OME- fluid behind the tympanic membrane) to acute otitis media (AOM- bulging of the tympanic membrane that may be painful) to chronic suppurative otitis media (CSOM- perforated tympanic membrane with chronic discharge).<sup>3</sup> The milder forms of disease can be difficult to recognise if you do not know what to look for.<sup>4</sup> Despite the availability of evidence-based guidelines, giving advice about treatment is a challenge because recommendations vary according to condition, age, risk of complications, and parental preference.<sup>5-8</sup>

## Clinical presentation of otitis media with effusion

It has been a busy day at the practice. Your last patient, Jimmy, is a 3-year-old child who has frequent episodic asthma. He is just getting over an exacerbation and is almost back to normal. As part of your routine examination, you perform otoscopy. His tympanic membranes look dull and you can't see a light reflex. You wonder if this is the sort of child who needs referral to an ENT surgeon. Your best friend from medical school is now training to be an ENT surgeon. You give her a call.

### *ENT Response.....*

Jimmy probably has otitis media with effusion (OME). This is when the middle ear fills with serous or mucoid fluid, often from Eustachian tube dysfunction. It may not cause any pain or other signs of infection (a "silent" disease). The effusion impedes the movement of the tympanic membrane in response to sound and causes a conductive hearing loss of around 25dB and 20% will have a hearing loss exceeding 35dB.<sup>9</sup> OME often occurs after an upper respiratory tract infection.<sup>10</sup> Other important risk factors include attending childcare, older siblings, passive smoke exposure, and family history.<sup>10</sup> If Jimmy has hearing loss due to OME, he may seem inattentive or disobedient. Clumsiness and nocturnal wakefulness (due to unidentified otalgia) are occasional symptoms of OME (Box 1).<sup>7 9</sup>

[Insert Box 1]

[Insert Figure 1]

The diagnosis of OME is confirmed if there is a non-bulging intact tympanic membrane with: i) reduced immobility on pneumatic otoscopy; ii) a type B (flat) tympanogram; or iii) an air-fluid level (Figure 1). Sometimes the air-fluid level(s) are seen as "bubbles" behind the tympanic membrane.<sup>7 9</sup> Fluid levels cannot be seen if the tympanic membrane is opaque (making pneumatic otoscopy or tympanometry essential).

There is no urgency to treat OME. It will usually resolve spontaneously within 1-2 months. However, there are circumstances when closer observation is indicated. For example, Jimmy should be called back if there are developmental issues (especially speech delay). In these cases, an audiogram is indicated as soon as it can be arranged. Otherwise, it is reasonable to wait 2-3 months and see if OME resolves spontaneously.<sup>5 7 9</sup> At this point in time, there is no indication for an ENT referral. Advice about effective communication strategies (getting close to child, ensuring they are paying attention, speaking clearly, and giving one message at a time) is always appropriate.<sup>5 7</sup>

Three months later, Jimmy is back again. He still has bilateral dull tympanic membranes. You now know how to confirm that middle ear effusions are present in both ears. You didn't realise that Jimmy's Aboriginal father had ear problems as a child. You were aware that Aboriginal children had high rates of discharging ears but you are not sure about OME.

*ENT Response.....*

OME is one of the most common conditions affecting all children. It has been the subject of large number of clinical trials and systematic reviews (Table 1).<sup>11-19</sup> Accurate incidence and prevalence data are difficult to attain (because OME may be present for short periods then resolve spontaneously). OME is the most common cause of acquired hearing loss and is much more common between 1-6 years of age. In at least 5% of low-risk children, OME is either very persistent or associated with frequent episodes of AOM.<sup>9</sup>

[Insert Table 1]

Aboriginal and Torres Strait Islander children suffer from the highest burden of middle ear disease in the world.<sup>20 21</sup> More than 90% of Aboriginal and Torres Strait Islander children living in remote areas experience onset of otitis media by 3 months of age.<sup>22 23</sup> By one year of age, up to a third of children will have had a perforated tympanic membrane. This is associated with the long-term sequelae of hearing loss, and reduced educational, employment, and life opportunities. Chronic perforations and chronic suppurative otitis media (CSOM) are not uncommon in Aboriginal and Torres Strait Islander children (currently ~15% in the Northern Territory).<sup>23</sup> These conditions usually cause the greatest hearing impairment.

The Royal Australasian College of Surgeons (RACS) together with the Australian Society of Head and Neck Surgeons (ASOHNS) has harnessed the enthusiasm and commitment of many ear health professionals across many specialities to address this disparity. This multidisciplinary and multi-sectoral approach involves a #earhealthforlife network. They are currently seeking the establishment of a national Aboriginal and Torres Strait Islander Hearing Health Taskforce that can provide evidence-based advice to Government about hearing health. The aim is to increase awareness of ear disease and to ensure all jurisdictions have responsible programs committed to high standards of care. We urgently need to decrease the risk of chronic ear infections and support Aboriginal and Torres Strait Islander children to achieve their educational potential.

### **The importance of hearing loss**

You understand that Jimmy's clinical management will be influenced by his hearing level and his speech development. In some regions, organising a hearing test can be difficult.

#### *ENT Response.....*

It is important to know the child's hearing threshold (where normal is <15dB). Hearing connects an individual to their environment and people. Language, learning and even simple interactive enjoyment requires the ability to hear. The long-term effects of hearing loss are well documented.<sup>24 25</sup> It is equally important to ensure good quality of life in the short-term. Reading stories, listening to language, attempting to join in conversations depend upon hearing. Since Aboriginal and Torres Strait Islander history is oral, hearing deficits may be eroding cultural transference.<sup>1</sup>

The Newborn Hearing screen (using auditory brainstem response, ABR) identifies congenital sensorineural hearing loss. Nearly all acquired hearing loss in children is conductive. An audiogram (with tympanometry) confirms the clinical diagnosis of OME, illustrates the current hearing loss to the family, and can be used to monitor progress over time.<sup>9</sup> Many different health professionals will be interested in knowing how the hearing loss is correlated with development, school achievement, and behavioural concerns. The extent to which speech and language are delayed depends upon the degree of hearing loss. While a 30dB hearing loss associated with bilateral OME is described as mild, this means that conversational voice sounds like a whisper and whispers are not heard. You can help parents understand what a 30dB hearing loss is like by getting them to stick their fingers in their ears. It is easy to understand how this conductive hearing loss might lead to inattention, frustration or misbehaviour.

Accurate assessment of the hearing level in children is challenging but always possible. In the clinic, the whisper test is helpful in adults (positive likelihood ratio >9) but difficult to do reliably in young children.<sup>26</sup> Under the age of 4 years old, audiologists will use Visually Reinforced Orientation Audiometry (VROA) or Behavioural Observation Audiometry (BOA). Over 4 years old, a Pure Tone Audiogram (PTA) is feasible.<sup>27</sup>

### **What is the role for tympanostomy tube surgery?**

The bilateral OME persists and the average pure tone hearing threshold is 30dB in the better hearing ear. Jimmy's mother is scared of surgery and will need some more information before she will agree to see an ENT surgeon.

#### *ENT Response.....*

The problem of OME is fluid in the middle ear space. The role of tympanostomy tubes is to ventilate the middle ear when Eustachian tube function has failed. It does not reverse Eustachian tube dysfunction (ETD). Tympanostomy tubes will clear the mucoid effusion and normalise hearing for the life of the tube (also known as a grommet). This is typically 6-12 months, depending upon the design of the tube.<sup>15</sup> In an attempt to address the underlying cause of ETD, it might also be appropriate to remove Jimmy's adenoids. Adenoidectomy reduces the risk of subsequent otitis media (especially for children 4 years and older).<sup>16 28</sup> The major inconvenience is that the grommet exposes the middle ear to the outside environment. This means that the ears should be kept dry to reduce the risk of discharge.<sup>18</sup> Some surgeons may advocate the incising the tympanic membrane and removing the effusion ("myringotomy") together with an adenoidectomy (without inserting a grommet). Proponents argue that this should reduce the risk of otitis media, while not leaving the child with a communication between the outer and middle ears (as a grommet will do). There is no clear evidence to inform how we should proceed (although an NHMRC funded trial is currently underway). Currently, the decision comes down to the individual's circumstances and family preference.

The placement of tympanostomy tubes requires a brief general anaesthetic. A small incision is made in the tympanic membrane, suction removes the effusion, and a small tube is placed across the tympanic membrane.<sup>29</sup> The flanges on the tube hold it in place and the hole in the middle ventilates the middle ear. Most children are home within a couple of hours. There is very little discomfort, although some discharge can be expected from the ear for a few days. The surgeon will frequently prescribe ciprofloxacin-based ear drops for 3-5 days after the operation, as this has been shown to

reduce the risk of continuing discharge from the ear after the procedure.<sup>17</sup> After the surgery, keeping water out of the ears to prevent aural discharge is usually recommended.<sup>18</sup> Simple measures, like obtaining some ear plugs, or placing some Vaseline on cotton wool at bath time will usually suffice. The hearing will be checked soon after the operation to ensure that it has returned to normal.

### Complications of tympanostomy tubes

The tubes are in and the hearing is back to normal. Jimmy's mother is happy the problem is finally over. Could there be any more problems?

#### *ENT Response.....*

Discharge through a tube (tympanostomy tube otorrhoea, TTO) is the most common complication and may affect up to 50% of children (Table 2).<sup>30 31</sup> It is usually not a major problem. Following the water precautions recommended by the surgical team may reduce risk. If the ears do discharge, Jimmy should commence oto-topical antibiotic drops.<sup>19</sup> Cleaning the pus out of the ear canal may be necessary so the antibiotic can get to the site of infection. TTO is usually treated with ciprofloxacin-based ear drops for a week. It doesn't matter whether these drops contain steroid or not (and ciprofloxacin-steroid drops can sting the ear a little). Ear drops provide a much high concentration of antibiotics at the site of infection and are much more effective than oral antibiotics.<sup>19</sup> After the drops have finished, Jimmy should have a check-up at the health clinic to ensure that the discharge has completely settled – the main reason for lingering aural discharge is incomplete resolution of the initial infection.

Sometimes grommets come out prematurely (~5% out before 3 months) or become blocked (5-10%).<sup>31 32</sup> Occasionally the eardrum does not heal after the grommet has extruded (2-3%).<sup>31 32</sup> This is not necessarily a problem if the perforation is dry and the child is still at high risk of ongoing OM (like having a grommet). Most of these tympanic membrane perforations will heal spontaneously. If not, it might be necessary to do another surgery to patch up the hole (myringoplasty) when the child is older. Occasionally a grommet will not extrude by itself, and an operation becomes necessary to remove it (5-10%).<sup>31 32</sup> This is likely to be recommended when the tympanostomy tube has been retained for 2-3 years and the risk of further OM is low.

More serious (rare) complications include cholesteatoma due to invagination of tympanic membrane skin through the tympanic membrane (~0.8%), and new sensorineural hearing loss (<<1%).<sup>29 31 32</sup> Cholesteatomas must be removed surgically.

[Insert Table 2]

### **Recurrent disease- what next?**

After 9 good months, Jimmy's mother thinks he is having trouble hearing again. What advice can you give at this stage?

*ENT Response.....*

It sounds as though the grommets may have extruded (or become blocked), and that Jimmy has glue ear once again. A check of the ears with pneumatic otoscopy and tympanometry will confirm this. If so, another audiogram is appropriate. Around 20-30% of children will meet the criteria for reinsertion of grommets. Most ENT surgeons would recommend an adenoidectomy if this was not done with the first set of tubes.<sup>16 28</sup> It is thought that the additional risk associated with adenoidectomy is justified if the child requires a second set of tubes.<sup>33</sup> An adenoidectomy improves ETD through mechanical removal of large adenoids and/or removal of the biofilm in the adenoids. There are multiple ways to do the operation. Most commonly, surgeons use suction diathermy, curette or coblation under direct or indirect vision.

### **Normal hearing- priorities for the future**

At least 5% of Australian children will experience chronic OME and/or recurrent AOM. Unfortunately, a much higher proportion of Indigenous children is affected. What needs to be done?

*ENT Response.....*

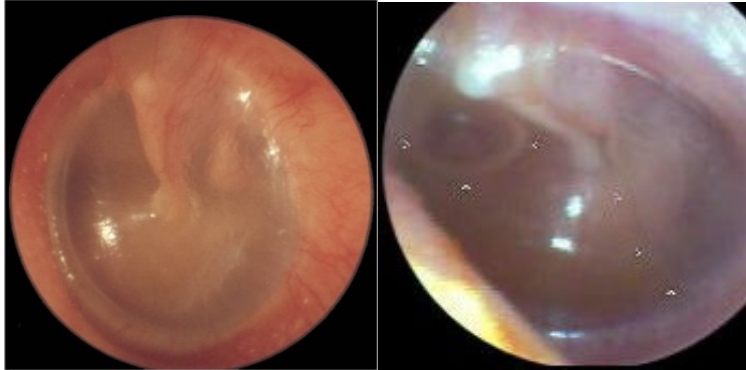
It is time that all Australian children with hearing loss had access to appropriate hearing support.<sup>20 34</sup> While most children with OM can be effectively managed in primary care, we need to get children requiring simple ENT procedures to improve hearing on to ENT surgery waiting lists. Access to appropriate healthcare services for children needs improvement. More priority must be given to children with significant hearing impairment within our hospitals. Long delays in hearing support may mean life-long social and economic disadvantage.

The types of hearing assessment available will increase with the use of tablet-based technologies that test hearing through play-based gaming strategies. This is being piloted by Australian Hearing in the testing of Indigenous children. While this may increase access to hearing

assessment, it may also identify many more children requiring treatment. Structural change in the health system will be required to meet the need.

[Insert Box 2]

**Figure 1 - Comparison of A: left tympanic membrane with features of a normal aerated middle ear (translucent TM with incus visible behind the handle of the malleus) and B: a left tympanic membrane with features of otitis media with effusion (retracted TM with handle of malleus pulled back and air fluid level visible anteriorly).**



A

B

**Box 1 Clinical features of otitis media with effusion in children**

Concurrent or preceding URTI

Hearing loss

Aural Fullness

Inattentive, disobedient

Challenging behavioural

Nocturnal wakefulness

Clumsiness

Asymptomatic (common in young children)

**Table 1 Cochrane Reviews relevant to the management of otitis media with effusion**

<b>Intervention</b>	<b>Outcome</b>	<b>Evidence</b>	<b>Effect</b>
Auto-inflation (vs no auto-inflation) <sup>11</sup>	Tympanometry improved (B, C2 to C1 or A) at 1 month or less	⊕⊕⊖⊖ Low 5 trials (325 children)	RR 1.47 [95% CI 0.69, 3.13]
Antibiotics for >10 days (vs placebo or no antibiotics) <sup>12</sup>	Resolution of OME at >6 months	⊕⊕⊖⊖ Moderate 5 trials (606 children)	RR 1.75 [95% CI 1.41, 2.18] <b>NNT 6</b>
Steroids (oral) plus antibiotics for 7-14 days (vs placebo plus antibiotics) <sup>13</sup>	Resolution of OME at 7-28 days	⊕⊕⊖⊖ Low 5 trials (409 children)	RR 1.99 [95% CI 1.14, 3.49] <b>NNT 5</b>
Steroids (topical nasal) daily for 3 months (vs placebo) <sup>13</sup>	Resolution of OME at 3 months	⊕⊕⊖⊖ Low 1 trial (172 children)	RR 1.11 [95% CI 0.85, 1.46]
Antihistamines and/or decongestants (vs placebo) <sup>14</sup>	Resolution of OME at 1 month	⊕⊕⊕⊕ High 7 trials (1177 children)	RR 0.99 [95% CI 0.92, 1.05]
Tympanostomy tubes (vs 'watchful waiting') <sup>15</sup>	Improvement in hearing level after 6-9 months.	⊕⊕⊕⊖ Moderate 3 trials (523 children)	<b>4.2dB improvement</b> [95% CI 2.4, 6.0]
Adenoidectomy (vs no adenoidectomy) <sup>16</sup>	Resolution of OME at 12 months	⊕⊕⊖⊖ Low 3 trials (172 children)	RD 0.29 (29%) [95% CI 19, 39] <b>NNT 4</b>
Topical antibiotics after surgery for 3-5 days to prevent TTO (vs no topical antibiotics) <sup>17</sup>	Ear discharge at 2 weeks post-operatively.	⊕⊕⊖⊖ Low 1 trial (372 children)	RR 0.54 [95% CI 0.3, 0.97] <b>NNT 15</b>
Water precautions (ear plugs) to prevent TTO (vs no ear plugs) <sup>18</sup>	Rate of TTO episodes per year	⊕⊕⊖⊖ Low 1 trial (172 children)	<b>Rate diff -0.36/yr</b> [95% CI -27, -45]
Topical antibiotics for TTO for 7 days (vs oral antibiotics) <sup>19</sup>	Resolution of discharge 2 weeks after treatment	⊕⊕⊕⊖ Moderate 1 trial (153 children)	RR 1.70 [95% CI 1.38 to 2.08] <b>NNT 3</b>

**Table 2 The risk of recognised complications of tympanostomy tubes** <sup>31</sup>

Complication	Risk
Discharge (tympanostomy tube otorrhea)	25-50%
Myringosclerosis (tympanosclerosis)	32%
Focal atrophy of tympanic membrane	25%
Blocked grommet	5-10%
Retained grommet	5-10%
Early extrusion	5%
Retraction pocket	3%
Chronic tympanic membrane perforation	2%
Cholesteatoma	0.8%
Sensorineural hearing loss	<<1%

## **Box 2 Important information about otitis media with effusion**

### **Take Home Messages**

Otitis media with effusion (OME) is a common condition in all children.

Australian Indigenous children have alarmingly high rates of early onset otitis media (including OME) and sequelae.

Hearing loss (and its consequences) is the most important complication of OME.

Children with early onset persistent bilateral OME and hearing loss or speech delay are most likely to benefit from interventions.

Insertion of tympanostomy tubes is one of the most common paediatric operations in Australia.

We need to ensure that all children get access to hearing support, including ENT surgery.

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