Otitis media in children

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Otitis media is the term used for a group of conditions characterized by inflammation of the middle-ear cleft. These conditions are particularly common in children where they present important diagnostic and therapeutic dilemmas.

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Otitis media (OM) implies inflammation in the middle ear (Kenna, 2000). The term includes acute otitis media (AOM) in which the inflammation is caused by a virus or bacteria. Earache and pyrexia are the predominant clinical features. Sometimes the eardrum ruptures (perforates), giving rise to a mucopurulent discharge.

Otitis media with effusion (OME) may not be an active inflammatory process but is characterized by fluid in the middle-ear cleft behind an intact drum. This is painless and causes conductive deafness (Kubba et al, 2000).

Chronic otitis media (COM) may be mucosal when there is a permanent perforation of the eardrum, or squamous epithelial, when there is retraction of the eardrum forming a pocket (Browning, 1997).

Much confusion and uncertainty has been brought about by the use of the term OM to describe these heterogeneous disorders (*Table 1*). This article reviews current thinking in the pathogenesis and management of each of the above conditions.

ACUTE OTITIS MEDIA

Pathogenesis

Infection in the middle-ear cleft is particularly common in children. It has been estimated that 50–80% of children have had AOM by the age of 3 years (Rovers et al, 2004). It occurs by retrograde spread from the nasopharynx into the middle-ear cleft.

Children are particularly prone to infection in the middle-ear cleft because the eustachian tube is shorter, wider and more horizontal than in the adult (*Figure 1*). In addition, children are more prone to upper respiratory tract infections in general because of the immaturity of the immune system and the ancillary defence mechanisms (Kenna, 2000).

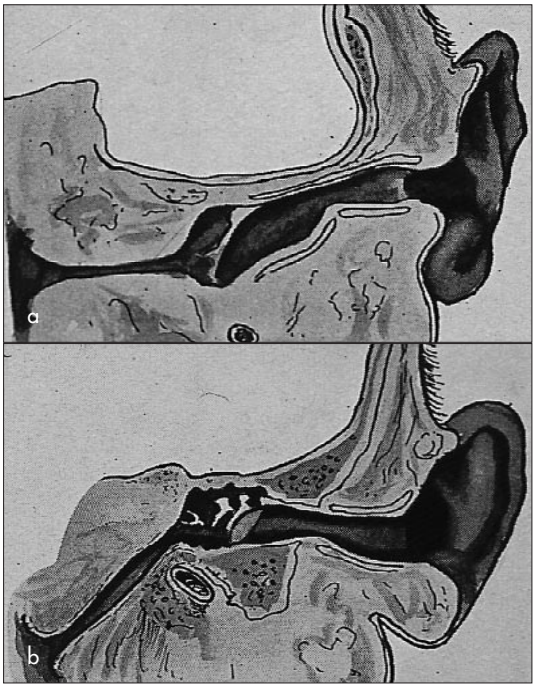
Presentation

AOM will usually present with severe earache. It is especially liable to develop in children in the first 2 years of life (Rovers et al, 2004). The child is fractious and distressed, often with a fever and general malaise. In young children there may be no localizing signs and presentation may simply be an unwell pyrexial baby.

TABLE 1.
Classification of otitis media

Acute otitis media	Viral or bacterial infection – painful, may be recurrent	
Otitis media with effusion	Fluid in the middle ear, intact drum Painless but causes deafness	
Chronic otitis media	Mucosal	Perforated eardrum, may discharge
	Squamous epithelial	Includes retraction pockets and cholesteatoma

Figure 1. The Eustachian tube in (a) the child and (b) adult.



Clinical examination should include careful otoscopy (*Figure 2*). This is a difficult diagnostic procedure in babies as it may not be possible to get a view of the eardrum, and if the baby is crying there is often erythema and fullness of the middle ear even in the absence of acute infection. For this reason, AOM is probably often misdiagnosed in the febrile child.

Initially, infection is typically viral. Evidence of a viral aetiology includes associated features of an upper respiratory tract infection such as rhinorrhoea and conjunctivitis. Secondary bacterial infection may supervene.

Management

Adequate analgesia is essential (*Table 2*). The child should be well hydrated. There is debate about whether oral antibiotics are routinely needed in the treatment of AOM. Meta-analysis has shown that 80% of children with AOM improve within 2–3 days without antibiotics. The incidence of complications of AOM seems to be the same whether the child is given antibiotics or not (Rosenfeld and Kay, 2003).

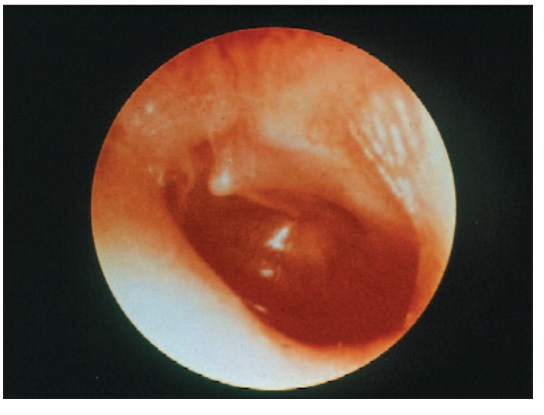
One approach would be to arrange careful review of the child after 24–48 hours. If the symptoms have not improved with supportive measures alone, then antibiotics can be prescribed. Amoxicillin is a good first-line antibiotic. There is no good evidence to support the routine use of expensive third- and fourth-generation cephalosporins (Del Mar et al, 1997).

Alternatively, the parents can be given a prescription for an antibiotic but advised to redeem it only if the child does not get better within a day or two – this is the so-called safety net antibiotic prescription (Cates, 1999).

Outcome

Often the pain will subside at the same time that the child develops a discharge. The parents find this alarming as it suggests that the eardrum has perforated, which it usually has. The majority of perforations of the eardrum in this situation heal without any adverse consequences so the parents can be reassured.

Figure 2. Acute otitis media – otoscopic view.



Recurrent acute otitis media

Some children develop recurrent acute otitis media (RAOM) (Rosenfeld and Kay, 2003). These are sometimes referred to as 'otitis-prone' children. In severe cases, earache becomes frequent and can significantly affect the child's quality of life.

Factors that predispose children to RAOM include day-care nurseries where children are exposed to a wide variety of respiratory pathogens. Passive smoking and bottle-feeding increase the prevalence of OM (Uhari et al, 1996). Children with cleft palate, Down's syndrome and immunodeficiency are also particularly at risk (*Table 3*).

The management of RAOM is the management of each episode as it occurs, given the natural history of the condition with a tendency for the child to 'grow out of it'. It is important to address issues such as parental smoking, which can help to reduce the risks (*Table 4*). If the condition is especially recalcitrant, prophylactic measures are considered. Long-term antibiotics do reduce the number of acute episodes of infection, but the impact is small. It has been recommended that this approach be used only in carefully selected cases and for a short duration such as during the winter months (Rovers et al, 2004).

TABLE 2.
Treatment of acute otitis media

Get the diagnosis right – not all otalgia is otitis
Analgesia is essential
Ensure the baby is well hydrated
Antibiotics controversial – reasonable for failed conservative treatment (24 hours) or where it is clinically evident that the initial viral infection has progressed to bacterial infection

TABLE 3.
Factors which make children 'otitis prone'

Day care or nursery
Passive smoking
Bottle-feeding
Cleft palate
Down's syndrome
Immunodeficiency

A recent study has shown that neither adenoidectomy nor long-term antibiotic prophylaxis had a significant effect on reduction of the number of episodes of AOM (Koivunen et al, 2004). The only intervention that has proven benefit is insertion of grommets; this reduces the number of acute infections by two per child per year (Rosenfeld et al, 2001).

Complications and sequelae

AOM is usually benign and self-limiting. The symptoms subside over a period of 2–3 days. Sometimes the eardrum ruptures giving rise to discharge. This is an innocuous event and the eardrum usually heals. In a minority of cases, the eardrum fails to heal, resulting in a persistent perforation – mucosal COM.

Serious complications associated with AOM are uncommon. Acute mastoiditis (*Figure 3*) presents with swelling behind the ear, increasing pain, pyrexia and discharge from the ear. In many cases, it can be treated with intravenous antibiotics, but constitutes a reason for urgent hospital referral (Bluestone, 2000; De et al, 2002). Other extracranial complications like facial paralysis and damage to the inner ear with resultant sensorineural hearing loss are exceptional.

Intracranial sepsis (*Figure 4*) and meningitis are now very rare in Western communities. Intracranial complications should be suspected if the child becomes progressively unwell or drowsy, or develops focal neurological signs.

OTITIS MEDIA WITH EFFUSION

Pathogenesis

OME ('glue ear') is defined as the presence of fluid in the middle-ear cleft in the presence of an intact drum persisting for 3 months or more (Gates et al, 2002). It is especially prevalent in pre-school children. Some 20% of children at any one time have middle-ear effusions. The condition is characterized by a tendency towards spontaneous resolution.

OME is caused by a number of factors that lead to eustachian tube dysfunction. These are endogenous factors relating to the anatomy in children, as described earlier, and exogenous factors such as a viral infection of the nasopharynx. OME may also result from an acute episode of middle-ear infection where the excessive mucin production overwhelms the natural clearing mechanisms leading to a fluid-filled middle ear, even after the infection has settled. There has been a suggestion recently that OME represents a bacterial 'biofilm' infection but further studies are required to prove or disprove this theory (Fergie et al, 2004).

It had been shown that day care, bottle-feeding, parental smoking and a positive family history are all risk factors for developing both RAOM and OME (Uhari et al, 1996).

Presentation

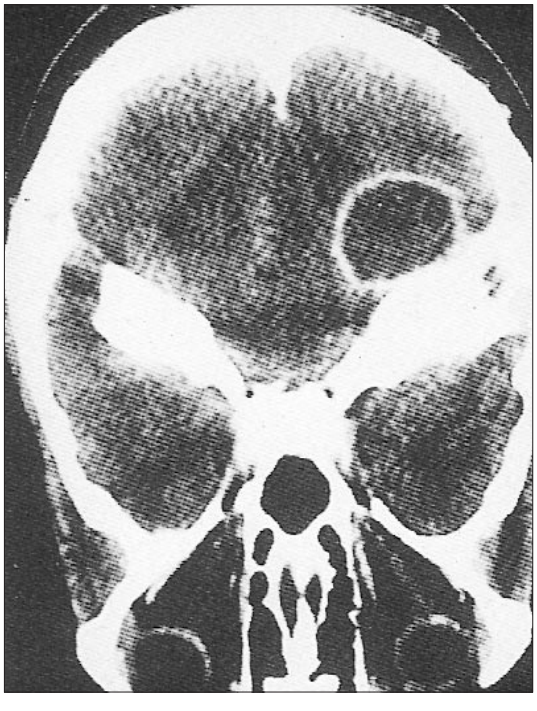
OME usually presents with deafness. It may be picked up on screening or commonly because of parental concern about the child's hearing.

TABLE 4.
Treatment of 'otitis prone' child

Reassure and expect improvement
Avoid passive smoking
Prophylactic antibodies rarely considered
Grommet in a small number of cases

Figure 3. Acute mastoiditis.

Figure 4. Intracranial abscess as a result of otitis media.



Some degree of middle-ear effusion following an episode of AOM is normal and does not require treatment unless it is persistent (Kubba et al, 2000).

Treatment

The treatment of OME is controversial (*Table 5*). Medical treatment in the form of antibiotics and decongestants probably has little role. However, there are favourable rates of spontaneous resolution, therefore a period of 'watchful waiting' (3 months) is recommended before consideration of surgical intervention.

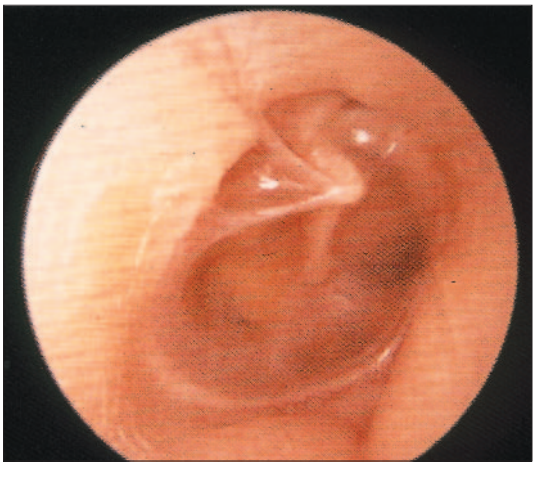
Surgery is usually recommended for symptomatic persistent OME and takes the form of the insertion of grommets (Rovers et al, 2004). Grommets bring about immediate improvement in hearing as they ventilate the middle-ear cleft (*Figures 5* and *6*). There may be some role for adjuvant adenoidectomy in this condition, but only if there is associated nasal obstruction or if a second set of grommets has to be inserted (Mattila et al, 2003).

A temporary hearing aid is sometimes considered. This approach is based on the high rate of natural resolution of this condition (Jardine et al, 1999). There are, however, problems in that many children and parents wish to avoid the stigma of a hearing aid. There are also logistical problems, with hearing-aid provision often taking a few months during which time the condition may resolve on its own.

TABLE 5.
Treatment of otitis media with effusion

Treatment not always needed – 'watchful waiting'
Grommets bring immediate improvements in hearing
Consider a temporary hearing aid
Adenoidectomy may have a role

Figure 5. Otitis media with effusion.



CHRONIC OTITIS MEDIA

COM is often preceded by one or more episodes of AOM. Mucosal COM implies the presence of a permanent perforation of the eardrum (*Figure 7*). There is an associated conductive hearing loss, but often this is remarkably small. A quiescent perforation of the eardrum (inactive mucosal COM) may cause little or no ill effects. In this situation, the child can be managed by keeping the ear as dry as possible to avoid ear infections.

Sometimes, a child with a perforated eardrum can get intermittent discharge particularly when he/she gets an upper respiratory tract infection, or if water goes into the ear. This is active mucosal COM. This condition can be a nuisance especially as the discharge is often profuse and foul-smelling.

Treatment

Active mucosal COM can be managed by treating the infections with oral or topical antibiotics or a combination of the two. There is controversy over the use of topical antibiotics in the presence of a perforation of the eardrum because the antibiotics currently used in eardrop formulations are known to be ototoxic. However, it is felt that the benefits of a short course of topical antibiotics outweigh the extremely small risk of damage to the inner ear. Quinolone antibiotic drops can be used as an alternative (Monoxides et al, 2004). They are not ototoxic but have not yet been approved for use in the ears in the UK.

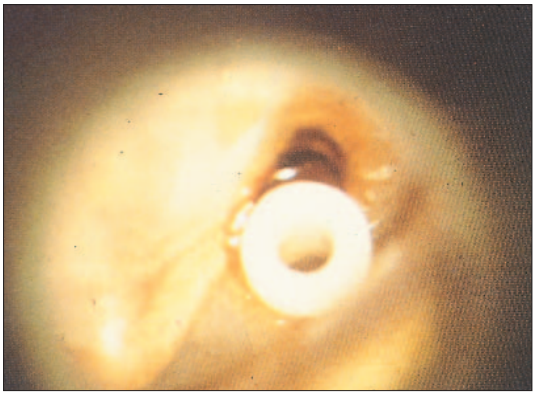


Figure 6. Grommet in the eardrum.

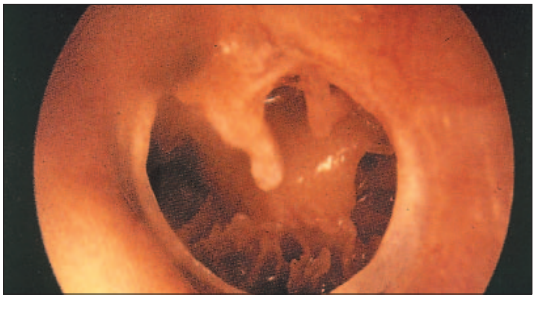


Figure 7. Perforated eardrum.

Occasionally, aural toilet is required, or even an examination under anaesthesia to remove excess granulation tissue or polyps that have formed as a result of inflammation of the middle ear mucosa.

Surgical repair of the eardrum (myringoplasty) can be undertaken, but this intervention is probably best deferred until the child is aged 10 years or more.

CHOLESTEATOMA

Cholesteatoma is a collection of squamous epithelial and inflammatory debris within a squamous epithelium-lined pocket in the middle-ear cleft. It is a progressive and erosive condition. Patients present with progressive hearing loss and recurrent discharge that may be scanty but foul smelling. If untreated, complications such as acute mastoiditis, labyrinthitis, facial palsy, meningitis and intracranial abscesses may occur. Therefore, this condition requires surgical intervention (*Figure 8*).

CONCLUSIONS

Appreciation that OM is a heterogenous group of diseases with different expectations from treatment for each variety is already making it easier to unravel the evidence base for rational treatment. Public-health measures such as encouraging breast-feeding and discouraging passive smoking may reduce prevalence. Vaccination against *Pneumococcus* is being widely trialed in the USA and may be useful particularly for vulnerable infants. Adjuvant adenoidectomy may have a role in improving outcome in OM with effusion and there is increasing inclination to consider hearing aids as a temporary measure, avoiding the potential complications of grommets. HM

Conflict of interest: none.

Bluestone CD (2000) Clinical course, complications and sequelae of acute otitis media. *Pediatr Infect Dis J* **19:** S37–46

KEY POINTS

- Worldwide, otitis media is a huge cause of morbidity in children.
- The term refers to a variety of conditions including acute otitis media (AOM), otitis media with effusion (OME) and chronic otitis media.
- Incidence of otitis media can be reduced by attention to preventive measures.
- AOM can usually be treated with supportive measures alone. Antibiotics should be used only when there is no response to conservative treatment.
- Recurrent AOM and OME have significant adverse effects on quality of life. The benefit of insertion of grommets has been proven in these conditions.

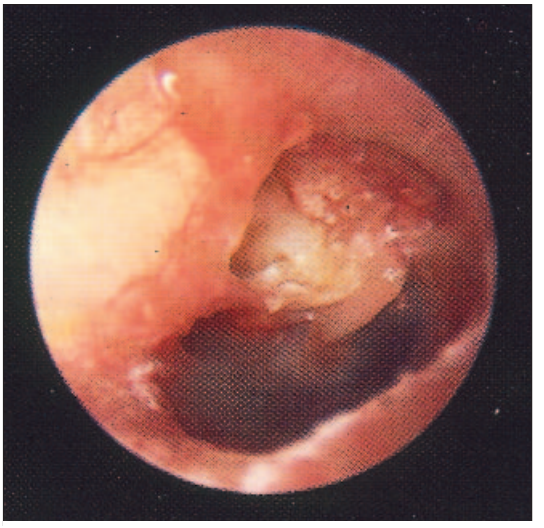


Figure 8. Cholesteatoma.

Browning GG (1997) Aetiopathology of inflammatory conditions of the external and middle ear. In: Kerr AG, Booth JB, eds. *Scott-Browns Otolaryngology.* Butterworth Heinemann, Oxford: 3/3/15–16

Cates C (1999) An evidence based approach to reducing antibiotic use in children with acute otitis media: controlled before and after study. *Br Med J* **318:** 715–16

De S, Makura ZGG, Clarke RW (2002) Paediatric acute mastoiditis: the Alder Hey experience. *J Laryngol Otol* **116:** 440–2

Del Mar C, Glasziou P, Hayem M (1997) Are antibiotics indicated as initial treatment for children with acute otitis media? A meta-analysis. *Br Med J* **314:** 1526–9

Fergie N, Bayston R, Pearson JP, Birchall JP (2004) Is otitis media with effusion a bio film infection? *Clin Otolaryngol* **29**(1): 38–46

Gates GA, Klein JO, Lim DJ et al (2002) Recent advances in otitis media, 1: definitions, terminology, and classification of otitis media. *Ann Otol Rhinol Laryngol* **111:** 8–18

Jardine AH, Griffiths MV, Midgley E (1999) The acceptance of hearing aids for children with otitis media with effusion. *J Laryngol Otol* **113:** 314–17

Kenna MA (2000) Diagnosis and management of acute otitis media and otitis media with effusion. In: Wetmore RF, Muntz HR, McGill TJ, eds. *Pediatric Otolaryngology, Principles and Practice Pathways.* Thieme, New York: 263–80

Koivunen P, Uhari M, Luotonen J, Kristo A, Raski R, Pokka T, Alho OP (2004) Adenoidectomy versus chemoprophylaxis and placebo for recurrent acute otitis media in children. *Br Med J* **328:** 487–90

Kubba H, Pearson JP, Birchall JP (2000) The aetiology of otitis media with effusion: a review. *Clin Otolaryngol* **25:** 181–94

Mattila P-S, Joki EVP, Kilpi T, Jokinen J, Herva E, Puhakka H (2003) Prevention of otitis media by adenoidectomy in children younger than 2 years. *Arch Otolaryngol Head Neck Surg* **129:** 163–8

Monoxides S, Friedman R, Hannley M et al (2004) Comparative efficacy of aminoglycoside versus fluoroquinolone topical antibiotic drops. *Otolaryngol Head Neck Surg* **130**(3 Suppl): S83–8

Rosenfeld RM (2001) Surgical prevention of otitis media. *Vaccine* **19:** S134–39

Rosenfeld RM, Bluestone CD (2003) Clinical efficacy of surgical therapy. In: Rosenfeld RM, Bluestone CD, eds. *Evidence-based otitis media*. 2nd edn. BC Decker, Hamilton, Ontario: 227–40

Rosenfeld RM, Kay D (2003) Natural history of untreated otitis media. In: Rosenfeld RM, Bluestone CD, eds. *Evidence-based otitis media.* 2nd edn. BC Decker, Hamilton, ON: 180–90

Rovers MM, Schilder AGM, Zeilhuis GA, Rosenfeld RM (2004) Otitis media. *Lancet* **7**(363): 465–73

Uhari M, Mantysaari K, Niemela M (1996) A meta-analytic review of the risk factors for acute otitis media. *Clin Infect Dis* **22:** 1079–83