Otitis media

Otitis media is a group of inflammatory diseases of the middle ear.[2] The two main types are **acute otitis media** (**AOM**) and **otitis media with effusion** (**OME**).[3] AOM is an infection of rapid onset that usually presents with ear pain.[1] In young children this may result in pulling at the ear, increased crying, and poor sleep.[1] Decreased eating and a fever may also be present.[1] OME is typically not associated with symptoms.[1] Occasionally a feeling of fullness is described.[4] It is defined as the presence of non-infectious fluid in the middle ear for more than three months.[4] **Chronic suppurative otitis media** (**CSOM**) is middle ear inflammation that results in discharge from the ear for more than three months.[7] It may be a complication of acute otitis media.[4] Pain is rarely present.[4] All three types of otitis media may be associated with hearing loss.[2][3] The hearing loss in OME, due to its chronic nature, may affect a child's ability to learn.[4]

The cause of AOM is related to childhood anatomy and immune function.[4] Either bacteria or viruses may be involved.[4] Risk factors include exposure to smoke, use of pacifiers, and attending daycare.[4] It occurs more commonly among indigenous peoples and those who have cleft lip and palate or Down syndrome.[4][8] OME frequently occurs following AOM and may be related to viral upper respiratory infections, irritants such as smoke, or allergies.[3][4] Looking at the eardrum is important for making the correct diagnosis.[9] Signs of AOM include bulging or a lack of movement of the tympanic membrane from a puff of air.[1][10] New discharge not related to otitis externa also indicates the diagnosis.[1]

Otitis media	
Other names	**Otitis media with effusion**: serous otitis media, secretory otitis media
 A bulging tympanic membrane which is typical in a case of acute otitis media	
Specialty	Otorhinolaryngology
Symptoms	Ear pain, fever, hearing loss[1][2]
Types	Acute otitis media, otitis media with effusion, chronic suppurative otitis media[3][4]
Causes	Viral, bacterial[4]
Risk factors	Smoke exposure, daycare[4]
Prevention	Vaccination, breastfeeding[1]
Medication	Paracetamol (acetaminophen), ibuprofen, benzocaine ear drops[1]
Frequency	471 million (2015)[5]
Deaths	3,200 (2015)[6]

A number of measures decrease the risk of otitis media including pneumococcal and influenza vaccination, breastfeeding, and avoiding tobacco smoke.[1] The use of pain medications for AOM is important.[1] This may include paracetamol (acetaminophen), ibuprofen, benzocaine ear drops, or opioids.[1] In AOM, antibiotics may speed recovery but may result in side effects.[11] Antibiotics are often recommended in those with severe disease or under two years old.[10] In those with less severe disease they may only be recommended in those who do not improve after two or three days.[10] The

initial antibiotic of choice is typically amoxicillin.[1] In those with frequent infections tympanostomy tubes may decrease recurrence.[1] In children with otitis media with effusion antibiotics may increase resolution of symptoms, but may cause diarrhoea, vomiting and skin rash.[12]

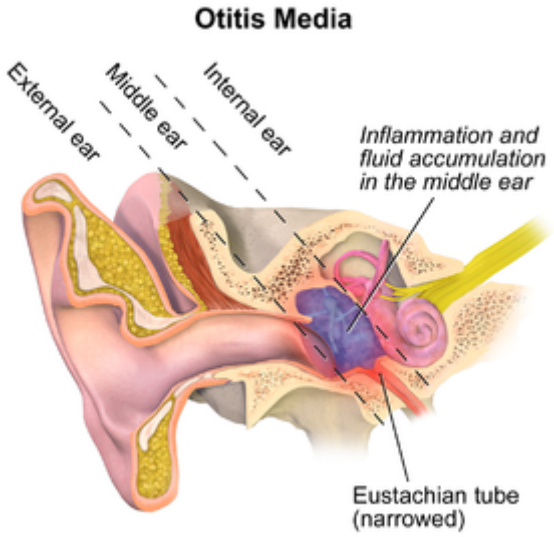
Worldwide AOM affects about 11% of people a year (about 325 to 710 million cases).[13][14] Half the cases involve children less than five years of age and it is more common among males.[4][13] Of those affected about 4.8% or 31 million develop chronic suppurative otitis media.[13] The total number of people with CSOM is estimated at 65-330 million people.[15] Before the age of ten OME affects about 80% of children at some point.[4] Otitis media resulted in 3,200 deaths in 2015 – down from 4,900 deaths in 1990.[6][16]

Contents

Signs and symptoms

An integral symptom of acute otitis media is ear pain; other possible symptoms include fever, irritability and diarrhea (in infants). Since an episode of otitis media is usually precipitated by an upper respiratory tract infection (URTI), there are often accompanying symptoms like a cough and nasal discharge.[17] One might also experience a feeling of fullness in the ear.

Discharge from the ear can be caused by acute otitis media with perforation of the ear drum, chronic suppurative otitis media, tympanostomy tube otorrhea, or acute otitis externa. Trauma, such as a basilar skull fracture, can also lead to discharge from the ear due to cerebral spinal drainage from the brain and its covering (meninges).



Otitis media.

Causes

The common cause of all forms of otitis media is dysfunction of the Eustachian tube.[18] This is usually due to inflammation of the mucous membranes in the nasopharynx, which can be caused by a viral upper respiratory tract infection (URTI), strep throat, or possibly by allergies.[19]

By reflux or aspiration of unwanted secretions from the nasopharynx into the normally sterile middle-ear space, the fluid may then become infected — usually with bacteria. The virus that caused the initial upper respiratory infection can itself be identified as the pathogen causing the infection.[19]

Diagnosis

As its typical symptoms overlap with other conditions, such as acute external otitis, symptoms alone are not sufficient to predict whether acute otitis media is present; it has to be complemented by visualization of the tympanic membrane.[20][21] Examiners may use a pneumatic otoscope with a rubber bulb attached to assess the mobility of the tympanic membrane. Other methods to diagnose otitis media is with a tympanometry, reflectometry or hearing test.


Perforation of the right tympanic membrane resulting from a previous severe acute otitis media

In more severe cases, such as those with associated hearing loss or high fever, audiometry, tympanogram, temporal bone CT and MRI can be used to assess for associated complications, such as mastoid effusion, subperiosteal abscess formation, bony destruction, venous thrombosis or meningitis.[22]

Acute otitis media in children with moderate to severe bulging of the tympanic membrane or new onset of otorrhea (drainage) is not due to external otitis. Also, the diagnosis may be made in children who have mild bulging of the ear drum and recent onset of ear pain (less than 48 hours) or intense erythema (redness) of the ear drum.

To confirm the diagnosis, middle-ear effusion and inflammation of the eardrum have to be identified; signs of these are fullness, bulging, cloudiness and redness of the eardrum.[17] It is important to attempt to differentiate between acute otitis media and otitis media with effusion (OME), as antibiotics are not

recommended for OME.[17] It has been suggested that bulging of the tympanic membrane is the best sign to differentiate AOM from OME, with a bulging of the membrane suggesting AOM rather than OME.[23]

Viral otitis may result in blisters on the external side of the tympanic membrane, which is called *bullous myringitis* (*myringa* being Latin for "eardrum").[24]

However, sometimes even examination of the eardrum may not be able to confirm the diagnosis, especially if the canal is small. If wax in the ear canal obscures a clear view of the eardrum it should be removed using a blunt cerumen curette or a wire loop. Also, an upset young child's crying can cause the eardrum to look inflamed due to distension of the small blood vessels on it, mimicking the redness associated with otitis media.

Acute otitis media

The most common bacteria isolated from the middle ear in AOM are *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*,[17] and *Staphylococcus aureus*.[25]

Otitis media with effusion

Otitis media with effusion (OME), also known as serous otitis media (SOM) or secretory otitis media (SOM), and colloquially referred to as 'glue ear,'[26] is fluid accumulation that can occur in the middle ear and mastoid air cells due to negative pressure produced by dysfunction of the Eustachian tube. This can be associated with a viral URI or bacterial infection such as otitis media.[27] An effusion can cause conductive hearing loss if it interferes with the transmission of vibrations of middle ear bones to the vestibulocochlear nerve complex that are created by sound waves.[28]

Early-onset OME is associated with feeding of infants while lying down, early entry into group child care, parental smoking, lack, or too short a period of breastfeeding and greater amounts of time spent in group child care, particularly those with a large number of children. These risk factors increase the incidence and duration of OME during the first two years of life.[29]

Chronic suppurative otitis media

Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear and mastoid cavity that is characterised by discharge from the middle ear through a perforated tympanic membrane for at least 6 weeks. CSOM occurs following an upper respiratory tract infection that has led to acute otitis media. This progresses to a prolonged inflammatory response causing mucosal (middle ear) oedema, ulceration and perforation. The middle ear attempts to resolve this ulceration by production of granulation tissue and polyp formation. This can lead to increased discharge and failure to arrest the inflammation, and to development of CSOM, which is also often associated with cholesteatoma. There may be enough pus that it drains to the outside of the ear (otorrhea), or the pus may be minimal enough to be seen only on examination with an otoscope or binocular microscope. Hearing impairment often accompanies this disease.

People are at increased risk of developing CSOM when they have poor eustachian tube function, a history of multiple episodes of acute otitis media, live in crowded conditions, and attend paediatric day care facilities. Those with craniofacial malformations such as cleft lip and palate, Down syndrome, and microcephaly are at higher risk.

Worldwide approximately 11% of the human population is affected by AOM every year, or 709 million cases.[13][30] About 4.4% of the population develop CSOM.[30]

According to the World Health Organization, CSOM is a primary cause of hearing loss in children.[31] Adults with recurrent episodes of CSOM have a higher risk of developing permanent conductive and sensorineural hearing loss.

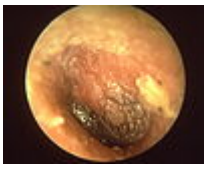
In Britain, 0.9% of children and 0.5% of adults have CSOM, with no difference between the sexes.[31]

The incidence of CSOM across the world varies dramatically where high income countries have a relatively low prevalence while in low income countries the prevalence may be up to three times as great.[13]

Each year 21,000 people worldwide die due to complications of CSOM.[31]

Adhesive otitis media

Adhesive otitis media occurs when a thin retracted ear drum becomes sucked into the middle-ear space and stuck (i.e., adherent) to the ossicles and other bones of the middle ear.



Acute otitis media

Acute otitis media, myringitis bullosa

Myringitis bullosa in influenza

Chronic otitis media (otitis media chronica mesotympanalis)

Otitis media chronica mesotympanalis

Otitis media chronica mesotympanalis

Otitis media chronica mesotympanalis

Prevention

AOM is far less common in breastfed infants than in formula-fed infants,[32] and the greatest protection is associated with exclusive breastfeeding (no formula use) for the first six months of life.[1] A longer duration of breastfeeding is correlated with a longer protective effect.[32]

Pneumococcal conjugate vaccines (PCV) in early infancy decrease the risk of acute otitis media in healthy infants.[33] PCV is recommended for all children, and, if implemented broadly, PCV would have a significant public health benefit.[17] Influenza vaccination in children appears to reduce rates of AOM by 4% and the use of antibiotics by 11% over 6 months.[34] However, the vaccine resulted in increased adverse-effects such as fever and runny nose.[34] The small reduction in AOM may not justify the side effects and inconvenience of influenza vaccination every year for this purpose alone.[34] PCV does not appear to decrease the risk of otitis media when given to high-risk infants or for older children who have previously experienced otitis media.[33]

Risk factors such as season, allergy predisposition and presence of older siblings are known to be determinants of recurrent otitis media and persistent middle-ear effusions (MEE).[35] History of recurrence, environmental exposure to tobacco smoke, use of daycare, and lack of breastfeeding have all been associated with increased risk of development, recurrence, and persistent MEE.[36][37] Pacifier use has been associated with more frequent episodes of AOM.[38]

Long-term antibiotics, while they decrease rates of infection during treatment, have an unknown effect on long-term outcomes such as hearing loss.[39] This method of prevention has been associated with emergence of antibiotic-resistant otitic bacteria. They are thus not recommended.[17]

There is moderate evidence that the sugar substitute xylitol may reduce infection rates in those who go to daycare.[40]

Evidence does not support zinc supplementation as an effort to reduce otitis rates except maybe in those with severe malnutrition such as marasmus.[41]

Management

Oral and topical pain killers are effective to treat the pain caused by otitis media. Oral agents include ibuprofen, paracetamol (acetaminophen), and opiates. Evidence for the combination over single agents is lacking.[42] Topical agents shown to be effective include antipyrine and benzocaine ear drops.[43] Decongestants and antihistamines, either nasal or oral, are not recommended due to the lack of benefit and concerns regarding side effects.[44] Half of cases of ear pain in children resolve without treatment in three days and 90% resolve in seven or eight days.[45] The use of steroids is not supported by the evidence for acute otitis media.[46][47]

Antibiotics

It is important to weigh the benefits and harms before using antibiotics for acute otitis media. As over 82% of acute episodes settle without treatment, about 20 children must be treated to prevent one case of ear pain, 33 children to prevent one perforation, and 11 children to prevent one opposite-side ear infection. For every 14 children treated with antibiotics, one child has an episode of either vomiting, diarrhea or a rash.[11] If pain is present, pain medications may be used.

For bilateral acute otitis media in infants younger than 24 months of age, there is evidence that the benefits of antibiotics outweigh the harms.[11] A 2015 Cochrane review concluded that watchful waiting is the preferred approach for children over six months with non severe acute otitis media.[48]

Summary[48]			
Outcome	**Findings in words**	**Findings in numbers**	**Quality of evidence**
Pain			
Pain at 24 hours	Antibiotics causes little or no reduction to the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.89 (0.78 to 1.01)	High
Pain at 2 to 3 days	Antibiotics slightly reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.70 (0.57 to 0.86)	High
Pain at 4 to 7 days	Antibiotics slightly reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.76 (0.63 to 0.91)	High
Pain at 10 to 12 days	Antibiotics probably reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on moderate quality evidence.	RR 0.33 (0.17 to 0.66)	Moderate
Abnormal tympanometry			
2 to 4 weeks	Antibiotics slightly reduces the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.82 (0.74 to 0.90)	High
3 months	Antibiotics causes little or no reduction to the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 0.97 (0.76 to 1.24)	High
Vomiting			
Diarrhoea or rash	Antibiotics slightly increases the chance of experiencing the outcome when compared with placebo for acute otitis media in children. Data are based on high quality evidence.	RR 1.38 (1.19 to 1.59)	High

The evidence indicates that most children older than 6 months of age who have acute otitis media do not benefit from treatment with antibiotics. If antibiotics are used, amoxicillin is generally recommended.[17] If there is resistance or use of amoxicillin in the last 30 days then amoxicillin-clavulanate or another penicillin derivative plus beta lactamase inhibitor is recommended.[17] Taking amoxicillin once a day may be as effective as twice[49] or three times a day. While less than 7 days of antibiotics have fewer side effects, more than seven days appear to be more effective.[50] If there is no improvement after 2–3 days of treatment a change in therapy may be considered.[17]

A treatment option for chronic suppurative otitis media with discharge is topical antibiotics. A Cochrane review found that topical quinolone antibiotics can improve discharge better than oral antibiotics.[51] Safety is not really clear.[51]

Tympanostomy tube

Tympanostomy tubes (also called "grommets") are recommended with three or more episodes of acute otitis media in 6 months or four or more in a year, with at least one episode or more attacks in the preceding 6 months.[17] There is tentative evidence that children with recurrent acute otitis media (AOM) who receive tubes have a modest improvement in the number of further AOM episodes (around one fewer episode at six months and less of an improvement at 12 months following the tubes being inserted).[52][53] Evidence does not support an effect on long-term hearing or language

development.[53][54] A common complication of having a tympanostomy tube is otorrhea, which is a discharge from the ear.[55] The risk of persistent tympanic membrane perforation after children have grommets inserted may be low.[52] It is still uncertain whether or not grommets are more effective than a course of antibiotics.[52]

Oral antibiotics should not be used to treat uncomplicated acute tympanostomy tube otorrhea.[55] They are not sufficient for the bacteria that cause this condition and have side effects including increased risk of opportunistic infection.[55] In contrast, topical antibiotic eardrops are useful.[55]

Otitis media with effusion

The decision to treat is usually made after a combination of physical exam and laboratory diagnosis, with additional testing including audiometry, tympanogram, temporal bone CT and MRI.[56][57][58] Decongestants,[59] glucocorticoids,[60] and topical antibiotics are generally not effective as treatment for non-infectious, or serous, causes of mastoid effusion.[56] Moreover, it is recommended against using antihistamines and decongestants in children with OME.[61] In less severe cases or those without significant hearing impairment, the effusion can resolve spontaneously or with more conservative measures such as autoinflation.[62][63] In more severe cases, tympanostomy tubes can be inserted,[54] possibly with adjuvant adenoidectomy[56] as it shows a significant benefit as far as the resolution of middle ear effusion in children with OME is concerned.[64]

Alternative medicine

Complementary and alternative medicine is not recommended for otitis media with effusion because there is no evidence of benefit.[27] Homeopathic treatments have not been proven to be effective for acute otitis media in a study with children.[65] An osteopathic manipulation technique called the Galbreath technique[66] was evaluated in one randomized controlled clinical trial; one reviewer concluded that it was promising, but a 2010 evidence report found the evidence inconclusive.[67]

Outcomes

Complications of acute otitis media consists of perforation of the ear drum, infection of the mastoid space behind the ear (mastoiditis), and more rarely intracranial complications can occur, such as bacterial meningitis, brain abscess, or dural sinus thrombosis.[68] It is estimated that each year 21,000 people die due to complications of otitis media.[13]

Membrane rupture

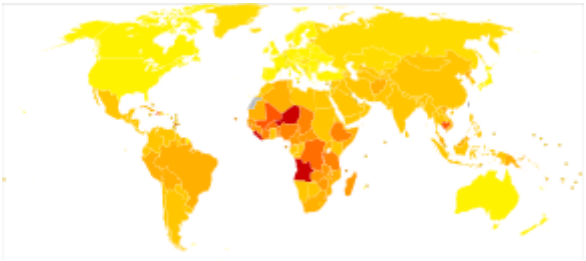
In severe or untreated cases, the tympanic membrane may perforate, allowing the pus in the middle-ear space to drain into the ear canal. If there is enough, this drainage may be obvious. Even though the perforation of the tympanic membrane suggests a highly painful and traumatic process, it is almost always associated with a dramatic relief of pressure and pain. In a simple case of acute otitis media in an otherwise healthy person, the body's defenses are likely to resolve the infection and the ear drum nearly always heals. An option for severe acute otitis media in which analgesics are not controlling ear pain is to perform a tympanocentesis, i.e., needle aspiration through the tympanic membrane to relieve the ear pain and to identify the causative organism(s).

Hearing loss

Children with recurrent episodes of acute otitis media and those with otitis media with effusion or chronic suppurative otitis media have higher risks of developing conductive and sensorineural hearing loss. Globally approximately 141 million people have mild hearing loss due to otitis media (2.1% of the population).[69] This is more common in males (2.3%) than females (1.8%).[69]

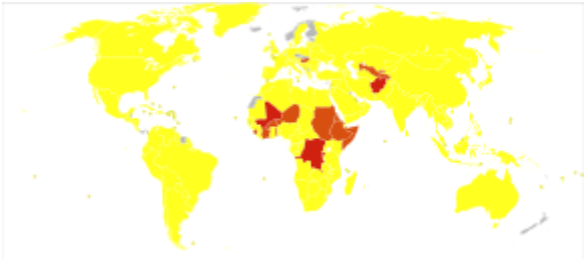
This hearing loss is mainly due to fluid in the middle ear or rupture of the tympanic membrane. Prolonged duration of otitis media is associated with ossicular complications and, together with persistent tympanic membrane perforation, contributes to the severity of the disease and hearing loss. When a cholesteatoma or granulation tissue is present in the middle ear, the degree of hearing loss and ossicular destruction is even greater.[70]

Periods of conductive hearing loss from otitis media may have a detrimental effect on speech development in children.[71] Some studies have linked otitis media to learning problems, attention disorders, and problems with social adaptation.[72] Furthermore, it has been demonstrated that patients with otitis media have more depression/anxiety-related disorders compared to individuals with normal hearing.[73] Once the infections resolve and hearing thresholds return to normal, childhood otitis media may still cause minor and irreversible damage to the middle ear and cochlea.[74]



Disability-adjusted life year for otitis media per 100,000 inhabitants in 2004.

- no data
- < 10
- 10-14
- 14-18
- 18-22
- 22-26
- 26-30
- 30-34
- 34-38
- 38-42
- 42-46
- 46-50
- > 50



Deaths from otitis media per million persons in 2012

- 0-0
- 1-1
- 2-4

Epidemiology

Acute otitis media is very common in childhood. It is the most common condition for which medical care is provided in children under five years of age in the US.[19] Acute otitis media affects 11% of people each year (709 million cases) with half occurring in those below five years.[13] Chronic suppurative otitis media affects about 5% or 31 million of these cases with 22.6% of cases occurring annually under the age of five years.[13] Otitis media resulted in 2,400 deaths in 2013—down from 4,900 deaths in 1990.[16]

Etymology

The term *otitis media* is composed of *otitis*, Ancient Greek for "inflammation of the ear", and *media*, Latin for "middle".

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Classification	**ICD-10**: H65 (http://apps.who.int/classifications/icd10/browse/2016/en#/H65)-H67 (http://apps.who.int/classifications/icd10/browse/2016/en#/H67) · **ICD-9-CM**: 017.40 (http://www.icd9data.com/getICD9Code.ashx?icd9=017.40), 055.2 (http://www.icd9data.com/getICD9Code.ashx?icd9=055.2), 381.0 (http://www.icd9data.com/getICD9Code.ashx?icd9=381.0), 381.1 (http://www.icd9data.com/getICD9Code.ashx?icd9=381.1), 381.2 (http://www.icd9data.com/

	getICD9Code.ashx?icd9=381.2), 381.3 (http://www.icd9data.com/getICD9Code.ashx?icd9=381.3), 381.4 (http://www.icd9data.com/getICD9Code.ashx?icd9=381.4), 382 (http://www.icd9data.com/getICD9Code.ashx?icd9=382) · **MeSH**: D010033 (https://www.nlm.nih.gov/cgi/mesh/2015/MB_cgi?field=uid&term=D010033) · **DiseasesDB**: 29620 (http://www.diseasesdatabase.com/ddb29620.htm)
External resources	**MedlinePlus**: 000638 (https://www.nlm.nih.gov/medlineplus/ency/article/000638.htm) · **eMedicine**: emerg/351 (https://emedicine.medscape.com/emerg/351-overview) ent/426 (http://www.emedicine.com/ent/topic426.htm#) complications, ent/209 (http://www.emedicine.com/ent/topic209.htm#) with effusion, ent/212 (http://www.emedicine.com/ent/topic212.htm#) Medical treat., ent/211 (http://www.emedicine.com/ent/topic211.htm#) Surgical treat. ped/1689 (http://ww

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