OTITIS MEDIA

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Otitis media is the inflammation of the middle ear mucosa, which includes the Eustachian tube, middle ear space, attic, aditus, antrum and mastoid air cells.

The age incidence varies from study to study but most agree that the peak incidence is between six and eighteen months. Between two thirds to three quarters of all children will have had at least one episode of acute otitis media by the age of two years.

Figures in the United States showed that 25% of the 120 million antibiotic prescriptions written per year are for the treatment of otitis media. Myringotomy with insertion of ventilation tubes is the most common surgical procedure performed on children under general anaesthetic. It has been estimated that the financial implications of medical and surgical treatment of otitis media in children under five years of age, exceeds five billion dollars per year.

Children who have an early otitis media onset are at high risk for recurrent acute and chronic otitis media as well as associated complications.

CLASSIFICATION

- Myringitis, which is an inflammation of the tympanic membrane, that occurs alone or in association with external otitis or otitis media.
- Acute suppurative otitis media, which refers to a clinically identifiable infection of the middle ear with sudden onset and short duration.
- Secretory otitis media, which refers to the presence of middle ear effusion behind an intact tympanic membrane without acute signs or symptoms. This term includes nonsuppurative or clinically non-infectious forms of otitis media.
- Chronic suppurative otitis media (chronic otitis media), which refers to a chronic discharge from the middle ear through a perforation of the tympanic membrane. Suppurative refers to active clinical infection. A perforation without discharge can be an inactive stage of the infection.

PATHOGENESIS

Acute otitis media usually follows viral upper respiratory tract infection, which in turn is followed by bacterial infection. Mechanical obstruction of Eustachian tube, dysfunction of the Eustachian tube, allergy, barotrauma or a combination of these factors contribute to the development of otitis media. Organisms invade the mucous mem-
brane causing inflammation, oedema and exudation. The inflammatory oedema causes occlusion of the Eustachian tube, preventing aeration and drainage. Due to the inflammatory process, pressure rises in the middle ear space, causing the tympanic membrane to bulge.

This is followed by necrosis of the tympanic membrane, resulting in a perforation with drainage of infected material until the infection resolves.

PREDISPOSING FACTORS
Predisposing factors to otitis media include passive smoking, cleft palate, Downs syndrome, other facial abnormalities, daycare attendance and presence of other siblings in the home, inhaled and ingested allergens, upper airway obstruction from enlarged adenoids and or tonsils, lowered resistance e.g. malnutrition, anaemia, immunological disorders, bottle-feeding with child lying supine and acid reflux.

DIAGNOSIS
History
The diagnosis of otitis media is often a presumptive one. There is usually a preceding history of an upper respiratory tract infection for several days before the child suddenly develops earache. A change in sleeping or feeding behaviour is important. Earache is often only present when the child is supine. History of allergy and nasal congestion and family history of middle ear disease are significant risk factors for recurrent otitis media.

Breast-feeding has been suggested as an important factor in prevention of otitis media. This might be due to immunological factors of value provided in breast milk that prevents various bacterial and viral infections. The facial muscle of breast-fed infants develops differently, and may promote Eustachian tube function. Aspiration of fluid into the middle ear can occur during bottle-feeding, especially when the child is lying supine.

Breast-fed infants are usually maintained in the semi-vertical position. Allergy to components in cows' milk or formula milk may result in immunological changes of middle ear mucosa.

Symptoms
Earache can vary from slight in mild cases, but usually is throbbing and severe. Crying and screaming is common. It is often relieved by perforation of the tympanic membrane. Deafness is always present in otitis media. This is a conductive deafness and is often accompanied by tinnitus. Irritability, touching of ears, nausea, vomiting, vertigo, change in sleeping and eating habits are usually present.

Examination
The examination of the external ear and eardrum requires adequate illumination. It is preferable to have an oto-
scope with a halogen lamp. Batteries should always be fully charged. Use the largest speculum that the ear canal can accommodate without causing pain. Pyrexia is usually present. There might be tenderness over the mastoid antrum. Visualisation of the entire tympanic membrane may be difficult because of wax or lack of co-operation. If a portion of the tympanic membrane is clearly inflamed, it is not necessary to remove wax to inspect the whole tympanic membrane. One should try and make notes of all anatomic landmarks and signs of inflammation.

The following is seen as the infection progresses:
- Loss of the light reflex.
- Vascularisation of the malleus and periphery of the tympanic membrane.
- General redness of the tympanic membrane.
- Bulging of the tympanic membrane, with formation of bullae on the tympanic membrane and adjacent external auditory meatus.
- Perforation of the tympanic membrane, with bloody and purulent discharge.

**BACTERIOLOGY IN ACUTE OTITIS MEDIA**

Acute otitis media is usually preceded by a viral upper respiratory tract infection.

The predominant bacteria are: *Streptococcus pneumoniae, Haemophilus influenzae* and *Moraxella catarrhalis*. All strains of *Moraxella catarrhalis* and the majority of *Haemophilus influenzae* produces beta-lactamase. The increasing incidence of penicillin resistance in *Streptococcus pneumoniae* is a worldwide phenomenon.

The following organisms can cause otitis media in neonates: *S. aureus*, *E. coli*, *Klebsiella*, Enterobacter species and *Pseudomonas aeruginosa*.

**TREATMENT OF ACUTE OTITIS MEDIA**

**Antibiotics**

**Amoxicillin**

This remains the drug of choice at a standard dosage of 40-50 mg/kg/day for ten days.

**Amoxicillin/clavulanate**

The addition of beta-lactamase inhibitor extends the spectrum of amoxicillin against beta-lactamase producing *Haemophilus influenzae* and *Moraxella catarrhalis*. In cases where antibiotics have recently been prescribed, a resistant streptococcus should be anticipated and amoxicillin should be prescribed at a dosage of 90 mg/kg/day in two to three divided doses for 10 days. The dosage of the clavulanate should not be increased.

**Oral cephalosporins**

The second generation cephalosporins, cefuroxime and cefpodoxime are the only oral cephalosporins that reach middle ear fluid levels above the MIC values for both penicillin sensi-
tive and intermediate sensitive *Streptococcus pneumoniae* and *Haemophilus influenzae*. Treatment should be given for 10 days.

**Parenteral cephalosporins**

Ceftriaxone should only be used after clinical failure of the previously mentioned antibiotics, or with proven penicillin resistant *Streptococcus pneumoniae*. Dosage: 50 mg/kg/day IV or IM, for three days.

**Other treatment**

**Analgesics**

Paracetamol and paracetamol with mefenamic acid, as well as aspirin and aspirin combinations in older children and adults.

**Anti-inflammatory**

Anti-inflammatory such as diclofenac, in doses of 3-4 mg/kg/day, are very effective given rectally. The patient should not be dehydrated when using anti-inflammatory.

**Nosedrops**

The role of local vasoconstrictive nasal drops is traditional, but their value is uncertain.

**Eardrops**

Eardrops are of no value in acute otitis media with an intact drum. Drops containing a local anaesthetic have no effect on keratinised squamous epithelium. They may even cause a sensitivity reaction of the meatal skin.

**Steroids**

Prednisolone given at 1 mg/kg as a morning dose for five days has been shown to be of value.

**Surgery**

Myringotomy is necessary when bulging of the tympanic membrane persists despite adequate antibiotic therapy. It is also indicated for persistent fever and pain. Pus should be sent for bacteriological assessment. With the history of recurrent otitis media, a ventilation tube must be inserted at the time of the myringotomy.

**Further management**

Acute otitis media is not cured until the hearing and appearance of the membrane return to normal. If resolution does not occur, adjacent infection in the nose, sinuses and or nasopharynx should be suspected. Low grade mastoid infection might be present.

**OTITIS MEDIA WITH EFFUSION**

Otitis media with effusion (OME) affects up to a third of children at some time in their lives. It is defined as the presence of liquid behind an intact eardrum without signs and symptoms of acute infection. Synonyms for otitis media with effusion include glue ear, serous and secretory otitis media.

The fluid in the middle ear causes a conductive deafness. The danger of OME lies in the apparent absence of symptoms. The potential impact on
Otitis media

hearing, speech, language and cognition, highlights the need for timely intervention. Otitis media with effusion can also occur in adults, usually following acute otitis media. In adults, nasopharyngeal malignancy must always be ruled out.

**Causes of otitis media with effusion**
- Middle ear effusion usually follows acute otitis media.
- Naso-pharyngeal obstruction, e.g. large adenoids, or tumor resulting in Eustachian tube dysfunction. It might be associated with recurrent attacks of acute otitis media. The colonization of the adenoid pad is seen to be more important than the bulk of the tissue.
- Otitic barotrauma as seen in scuba diving or descent in an aircraft.
- Allergic rhinitis can predispose to middle ear effusion.
- Parental smoking has been shown to predispose to otitis media with effusion in children.

**Symptoms and signs**
Symptoms include deafness, discomfort, tinnitus and occasionally unsteadiness.

A sign of otitis media with effusion is visible fluid behind the intact tympanic membrane.

There may be retraction of the malleus and there is a blue-gray discolouration of the tympanic membrane.

Air bubbles can be seen behind the tympanic membrane. With pneumatic otoscopy it is apparent that the tympanic membrane has lost its normal flaccidity. Tympanometry gives a typical flat curve.

**Treatment**

**Primary control**
Reduce the contributory factors, like passive smoking, inhaled allergies, food allergies, viral upper respiratory tract infections, exposure to a crèche environment, and protect the very young with immature immune systems. Many cases of otitis media with effusion resolve spontaneously.

- If no antibiotics have been given, treat with an antibiotics as for acute otitis media.
- Oral prednisone 1 mg/kg as a single morning dose for five days, followed by 0.5 mg/kg/day for the next five days has been shown to be of benefit. Contra-indications for steroid therapy, include recent varicela exposure and general immunological depression. Adverse effects are inter alia agitation, behavioural changes and sleep disturbance.
- The role of anti-histamines and mucolytics is uncertain and are probably of no benefit.
- Oto-inflation of the middle ear with the nasal tube and balloon, has been found to be effective by some investigators.
Surgical treatment

Adenoidectomy is indicated when there are clinical and radiological signs of nasopharyngeal obstruction. Even removal of small adenoids is indicated as this reduces the colonization of the nasopharynx.

Myringotomy and grommet insertion is indicated after medical therapy has failed. The literature suggests ventilation of middle ear if fluid is still present after four to twelve weeks of medical treatment. The function of the grommet is to ventilate the middle ear. The grommets extrude after an average time of six months.

Complications of middle ear infections

Complications occur when infection spreads beyond the muco-periosteal lining of the middle ear. The development of complications is influenced by the following factors: virulence of the organism, the host immune state and adequacy of treatment. Classically the onset of complications is heralded by sudden deterioration of the patient's general condition. The development of complications in the presence of inadequate antibiotic therapy is often insidious.

The insidious onset and relative rarity of the conditions means that they are often recognized late. Complications of acute otitis media usually respond well to medical treatment as well as drainage of middle ear.

Intra-temporal complications

Mastoiditis

This occurs when the infection spreads beyond the muco-periosteal lining. There is occlusion of the aditus causing back pressure, which results in osteitis and bone necrosis. Spreading of the mastoiditis to the petros apex can cause involvement of the abducent nerve and trigeminal ganglion.

This leads to the so-called Gradenigo syndrome with the classical triad of otitis media, lateral rectus palsy and pain in the trigeminal distribution. A common diagnostic dilemma for the general practitioner is the febrile child with severe otalgia and swelling behind the ear. This child is normally referred to the specialist with diagnosis of acute mastoiditis. Look out for postauricular glands and scalp infection. If the tympanic membrane and hearing are normal, it is not mastoiditis.

Facial palsy

This probably occurs due to direct pressure on the nerve because of a congenital dehiscence of the Fallopian canal.

Labyrinthitis

The membranous labyrinth is protected by the osseus labyrinth. Unless the bone is breeched (as seen in cholesteotoma), infections are rare. The infection may enter via one of the windows, or via the internal auditory meatus. Symptoms may also occur due to pres-
sure changes, caloric effect of hyperaemia, and/or absorptions of toxins. Labyrinthitis presents with vertigo and/or hearing loss.

Extra-temporal complications
Sub-periosteal abscess follows the spread of infection through the mastoid cortex. Sub-periosteal abscess over the mastoid antrum gives the typical retro auricular swelling and antro-inferior displacement of the pinna.

With breaking through the mastoid tip, an abscess forms in the neck – the so called Bezold’s abscess. If the infection spreads through the zygomatic arch, it presents with swelling over the zygoma.

Intracranial complications
Meningitis
The most common intracranial complication of otitis media. The physician must maintain a high degree of suspicion.

Symptoms suggestive of suppurative intracranial complications, especially if the child is receiving antibiotics, include headache, lethargy, severe earache, irritability, malaise, persistent fever, nausea and vomiting.

Lateral sinus thrombosis
Adjacent mastoiditis causes inflammation of the adventitia of the sinus and penetration of the venous wall. Thrombus formation and embolisation can occur and bacteriaemia is common.

Extradural abscess
Results from bone destruction adjacent to the dura.

Focal otitic encephalitis
Occurs when brain becomes oedematous and inflamed due to infection.

Brain abscess
Follows focal encephalitis.

Signs and symptoms more specific to CNS complications
These include neck stiffness, local seizure attacks, ataxia, blurred vision, papilloedema, diplopia and hemiplegia.

WHEN TO REFER
- Acute otitis media in patient who is critically ill or appears septicemic.
- Acute otitis media with poor response to antibiotic treatment.
- Appearance of suppurative complications of otitis media.
- Otitis media in a newborn child or patient with primary or secondary immune deficiency.
- Serous otitis media not responding to medical treatment.

WHAT IS NEW IN PREVENTION OF OTITIS MEDIA
New treatments in the prophylaxis of otitis media include:

Pneumococcal vaccines
Studies, performed in California and Finland demonstrated a reduction in
pneumococcal AOM after administration of a polyvalent pneumococcal vaccine.

Interfering bacteria
Researchers have observed that the noses and throats of children who are prone to ear infections harbor smaller numbers of the 'friendly' bacteria that help prevent overproduction of the harmful bacteria, than children without frequent infection.

A study in Sweden employed a nasal spray containing harmless bacteria called alpha streptococci, which are normally found in the throat and compete for space with harmful bacteria. In the study, the bacteria helped to protect against recurrent otitis media in susceptible children.

Antiviral agents
In one study, the administration of the anti-viral drug, zanamivir in the nasal passages of adults with influenza, reduced middle ear abnormalities from 73% to 32%. This drug is available for children older than seven years for treatment of influenza, but no research has determined its value for preventing or treating otitis media in children.

INFLUENZA VACCINES
The following children over six months of age should be vaccinated against influenza:

- Any child with a condition that requires regular medical care
- Any child who has been hospitalized for a serious illness (particularly lung and kidney diseases, diabetes, sickle-cell anaemia, or immune deficiencies.)

REFERENCES

FURTHER READING