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Otitis media in children: Risk factors & causative organisms

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Abstract---Otitis media is inflammation of the middle ear and the tympanic membrane, which often occurs as a result of an acute upper respiratory tract infection. Generally, it is caused by a viral infection that is then complicated by a secondary bacterial infection. However, the initial infection may also be bacterial. Otitis media is very common in children and there is a high rate of spontaneous recovery. It has been suggested that it is an unavoidable illness of childhood and part of the natural maturation of a child's immune system. Despite this, supportive complications can occur, such as perforation of the tympanic membrane, otitis externa and mastoiditis, as well as other sequelae affecting balance, motor control and hearing.

Keywords---otitis media, supportive, inflammation, risk factors.

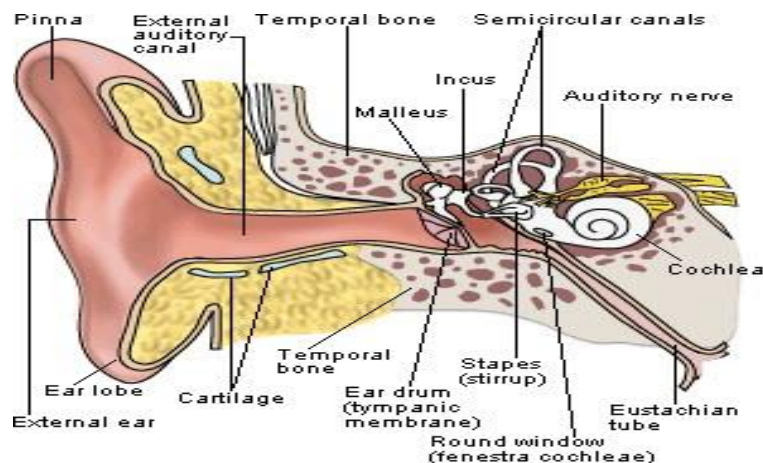
Introduction

Otitis media is the inflammation of the mucous membrane of the middle ear cleft which includes the middle ear cavity (tympanic cavity), mastoid antrum, mastoid air cells and the Eustachian tube [1]. When the inflammation is associated with a discharge from the ear through a perforation in the tympanic membrane, suppurative (or discharging) otitis media occurs. It may be acute (<6 weeks) or chronic (>6 weeks) [2]. It is one of the most common infectious diseases of childhood worldwide [3]. Two out of three children will have at least one episode of otitis media before their third birthday [1]. Varying prevalence rates of otitis media have been documented from various parts of the world [4]-[6]. Infants and young children are at highest risk of developing otitis media, with peak prevalence between 6 and 36 months of age [3]. It is particularly prevalent among children with cleft palate and other craniofacial defects, and those from lower socio-economic status [3] [7]. Bacteria have remained the most important etiological agents in suppurative or discharging otitis media [8]-[10]. Resistance to multiple antibiotics is not uncommon, further predisposing to complications among affected children [11] [12]. This review highlights the clinical features, current trends and challenges in the management of childhood otitis media.

OM is a major health problem and occurs with a high incidence and prevalence in both developed and developing countries (13,14). ASOM is a common childhood illness and can progress to CSOM (15). Although the use of antibiotics for treatment has reduced the number of acute complications, the number of chronic complications appears to be increasing (16). Understanding the epidemiology and microbiology of OM may facilitate development of strategies for primary prevention and better management of the disease (17). Although many organisms may be responsible for development of ASOM, three organisms account for the majority of infections (6). However, there are variations in different localities of the world and the response of these isolates to antibiotics may vary in different sites (18,19). A wide range of organisms may be isolated from cases of CSOM. The increasing emergence of bacterial strains, which are resistant to known antimicrobial agents, is a significant cause of treatment failure (20, 21, 22). This study was performed to evaluate the risk factors of OM and to identify the causative organisms in our locality.

Causes

The common cause of all forms of otitis media is dysfunction of the Eustachian tube. [19] 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.[20] 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.



Pathogenesis and risk factors

Otitis media is generally defined by the presence of effusion within the middle ear without reference to its cause or pathogenesis. Acute otitis media (AOM) is usually associated with the rapid onset of symptoms and signs of acute infection in the middle ear space, including fever, otalgia, inflammation or bulging of the tympanic membrane, and purulent middle ear effusion. However, there is no constellation of signs and symptoms that has been universally accepted in

establishing this diagnosis [23]. Otitis media with effusion (OME) is the presence of serous, mucoid, or mucopurulent fluid in the middle ear without acute symptoms. (24)

The pathogenesis of otitis media is multifactorial, including infection, impaired eustachian tube function, immature immune status, and allergy. In most cases, otitis media begins with a viral infection of the upper respiratory tract that causes congestion of the eustachian tube and impairment of normal tubal function, including middle ear ventilation, ciliary clearance, and drainage. As a result, pathogens colonizing the nasopharynx may gain access to the middle ear space and multiply; in such cases, acute symptoms (AOM) may develop. Immune responses, with or without antimicrobial therapy, will normally eradicate the infection and the acute symptoms; however, effusion (OME) may persist until normal tubal function returns. Glycoproteins secreted into the middle ear from goblet cells stimulated by the inflammatory process may impart to the fluid a mucoid texture, thereby slowing its resolution [24]. Bacterial biofilm formation has also been demonstrated in OME and implicated in its persistence [25,26]. It has been postulated that viable bacteria are organized through complex intercellular communication within biofilms, affording protection from phagocytosis through formation of an exopolysaccharide matrix. This results in reduced metabolism and relative resistance to antibiotics and to growth in tissue culture.

Signs and symptoms of ear infection

Your child may experience some of these common symptoms of an ear infection:

- 1- Ear pain (most common complaint)
- 2- Unusual irritability
- 3- Difficulty sleeping or staying asleep
- 4- Tugging or pulling at one or both ears
- 5- Fever
- 6- Fluid draining from the ear
- 7- Loss of balance
- 8- Hearing difficulties
- 9- Poor feeding

The symptoms of an ear infection may resemble other conditions or medical problems. Always consult your child's physician for a diagnosis.

Medical terminology and related conditions

Because your healthcare provider may use these terms, it's important to have a basic understanding of them:

- Acute otitis media (middle ear infection): This is the ear infection just described above. A sudden ear infection, usually occurring with or shortly after cold or other respiratory infection. The bacteria or virus infect and trap fluid behind the eardrum, causing pain, swelling/bulging of the eardrum and results in the commonly used term "ear infection." Ear infections can

occur suddenly and go away in a few days (acute otitis media) or come back often and for long periods of time (chronic middle ear infections).

- Otitis media with effusion: This is a condition that can follow acute otitis media. The symptoms of acute otitis media disappear. There is no active infection but the fluid remains. The trapped fluid can cause temporary and mild hearing loss and also makes an ear infection more likely to occur. Another cause of this condition is a block in the eustachian tube not related to the ear infection.
- Chronic supportive otitis media: This is a condition in which the ear infection won't go away even with treatment. Over time, this can cause a hole to form in the eardrum.

Patients and Methods Characteristics of Patients

The study included 210 patients with OM ranging in age from 4 months-11 years. They were selected from the ENT outpatient clinic, Al-Hussein Teaching Hospital, Samawah, Al-Muthanna, Iraq . Patients were classified into three groups:

- a) Group I: 112 patients with ASOM (91 with perforated tympanic membrane and 21 without perforation).
- b) Group II: 60 patients with SOM,
- c) Group III: 38 patients with CSOM (21 with discharging ears and 17 with dry ears). In addition, 210 age and sex-matched healthy children, who never complained about ear troubles, served as controls. They were selected from the Ophthalmology and Dermatology clinics. Patients and controls were subjected to a full history taking and complete physical examination. Tympanometry (for children > 6 months) and audiometry (for children > 4 years) were performed as previously escribed (10). An informed consent was obtained from the parents of the children before enrollment in the study.

Sample Collection and Bacteriological Examination

Samples were carefully obtained from the discharging ears using small sterile swabs after cleaning the external auditory meatus with a sterile dressing on a probe. Children with history of antibiotic use in the last two weeks were excluded. Samples were cultured immediately onto plates of blood agar, MacConkey agar, and chocolate agar. The blood and MacConkey agar plates were incubated aerobically at 37°C while chocolate agar plates were incubated at 35-37°C in presence of 5-10% CO₂. In addition, direct films were prepared and examined after Gram staining. After 24-48 hours incubation, plates were examined and standard microbiological techniques were used for bacterial identification (23, 24).

Results

Bacterial causative organisms

Bacterial cultures were performed for 112 patients with ASOM. Ten cultures showed no bacterial growth and five cases showed mixed cultures. On the other hand, all the 38 CSOM patients evaluated had positive cultures. The result show the *S. pneumoniae* and *Staph. aureus* were the most common isolates among

cases of ASOM (21.3% and 20.2%) while *Proteus mirabilis* (34%) and *P. aeruginosa* (24.71%) were the most common isolates from CSOM cases. The result shows that the rate of detection of *H. influenzae* was significantly ($P<0.05$) higher among infants and preschool children compared to school-aged children. On the other hand, *P. aeruginosa* was more significant ($P<0.05$) among school-aged children. However, there was no significant effect of age on other organisms.

Management and Treatment

Treatment of ear infections depends on age, severity of the infection, the nature of the infection (is the infection a first-time infection, ongoing infection or repeating infection) and if fluid remains in the middle ear for a long period of time. Your healthcare provider will recommend medications to relieve you or your child's pain and fever. If the ear infection is mild, depending on the age of the child, your healthcare provider may choose to wait a few days to see if the infection goes away on its own before prescribing an antibiotic.

Antibiotics

Antibiotics may be prescribed if bacteria are thought to be the cause of the ear infection. Your healthcare provider may want to wait up to three days before prescribing antibiotics to see if a mild infection clears up on its own when the child is older. If your or your child's ear infection is severe, antibiotics might be started right away.

If your healthcare provider prescribes an antibiotic, take it exactly as instructed. You or your child will start feeling better a few days after starting treatment. Even if you feel better and when pain has gone away, don't stop taking the medication until you were told to stop. The infection can come back if you don't take all of the medication. If the antibiotic prescribed for your child is a liquid, be sure to use a measuring spoon designed for liquid medications to be sure that you give the right amount. A hole or tear in your eardrum caused by a severe infection or an ongoing infection (chronic suppurative otitis media) is treated with antibiotic eardrops and sometimes by using a suctioning device to remove fluids. Your healthcare provider will give you specific instructions about what to do.

Pain-relieving medications

Over-the-counter acetaminophen or ibuprofen can help relieve earache or fever. Pain-relieving eardrops can also be prescribed. These medications usually start to lessen the pain within a couple hours. Your healthcare provider will recommend pain-relieving medications for you or your child and provide any additional instructions. Never give aspirin to children. Aspirin can cause a life-threatening condition called Reye's Syndrome. Earaches tend to hurt more at bedtime. Using a warm compress on the outside of the ear may also help relieve pain. (This is not recommended for infants.).

Complications of Otitis Media

Complications of suppurative otitis media develop if infection spreads from the middle ear cleft to structures from which this mucosa-lined space is usually separated by bone. The complications are generally classified into 2 main groups:

Intratemporal (within the confines of the temporal bone)

Hearing impairment: It is more pronounced and prolonged in chronic than acute suppurative otitis media. Acute mastoiditis: Refers to the inflammation of the mucosal lining of antrum and the bony walls of the mastoid air cell system. It follows acute suppurative otitis media; the determining factors being high virulence of organisms or lowered resistance in the patient. Petrositis results when the infection spreads from the middle ear and mastoid to the petrous part of temporal bone. Diagnosis can be confirmed by x-rays (Towne's and Stenver's views) and computerized axial tomography of the temporal bone. Labyrinthitis results if the infection progresses to involve the labyrinth. Facial paralysis can occur as a complication of both acute and chronic otitis media. Facial nerve function fully recovers if acute otitis media is controlled with systemic antibiotics. Myringotomy or cortical mastoidectomy may be required.

Intracranial complications of otitis media

Collection of pus between the bone and dura may occur both in acute and chronic infections of the middle ear giving rise to extradural abscess. Pus can also collect between the dura and arachnoid leading to subdural abscess. Inflammation of the leptomeninges (pia and arachnoid) and of the cerebro-spinal fluid (CSF) can result in meningitis. Cerebral abscess is another serious complication of acute otitis media in children. It is often associated with extradural abscess. Cerebellar abscess is a direct extension through the Trautmann's triangle or by retrograde thrombophlebitis. Generally, brain abscess is often associated with other complications, such as extradural abscess, peri-sinus abscess, meningitis, sinus thrombosis and labyrinthitis. Thus, the clinical picture may be overlapping.

Conclusion

Otitis media continues to affect millions of children around the world annually with attendant complications. High index of suspicion is required to ensure prompt diagnosis and treatment in order to drastically reduce the incidence of complications.

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