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CLINICAL STUDY

Severe acute otitis media in children

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Abstract: Acute otitis media (AOM) is one of the most common infections in children. Recently it was noticed that there is a marked increase in relapse of severe acute otitis media in children. There is also an increase in number of hospitalized children due to severe AOM, with etiological agent resistant to antibiotics. There is a rise of infections, caused by highly resistant Streptococcus pneumoniae, too.
Authors retrospectively reviewed children hospitalized at the Children's ENT Department in Children's University Hospital in Bratislava, from January 2005 to December 2006, due to severe acute otitis media. They mainly focused on etiological agent, antibiotics resistance as well as alternatives of treatment and prevention of severe AOM.
During 2 years, there were 76 children aged from 4 months to 14 years hospitalized with severe AOM. The most frequent etiological agent was Streptococcus pneumoniae in 37 cases; this was almost in 70 % of cases resistant to routine antibiotics. In 7 cases there was mastoiditis, and mastoidectomy or antrotomy had to be done in 6 cases.
To establish a diagnosis and start appropriate treatment it is necessary to identify etiological agent and its sensitivity. An increasing bacterial resistance is forcing us to prescribe antibiotics rationally. When severe AOM occurs, tympanotomy and insertion of ventilation tubes, exceptionally mastoidectomy, is often required *(Fig. 13, Tab. 3, Ref. 18).* Full Text (Free, PDF) *www.bmj.sk.*
Key words: otitis media, Streptococcus pneumoniae, infection, tympanic membrane TM, middle ear effusion MEE, bacterial resistance, antibiotics.

Acute otitis media (AOM) is extremely common in early childhood. By the age of 3 months, 10 % of children suffer at least one episode (1). It is estimated that approximately 50 % of children experience at least one episode of AOM during the first year of life (2). It is the most common cause for childhood visits to a physician's office (3) and it is the most common indication for the prescription of antibiotics (4, 5, 6). Peak prevalence of AOM occurs in children aged 6–18 months. Although AOM can occur at any age, 80–90 % of cases occur in children younger than 4–5 years. Many studies had shown an increased incidence in boys, but recent studies show an equal prevalence in males and females (2). Acute otitis media is an inflammation of the pneumatic spaces of the temporal bone, that means the middle ear including the mucosus membranes of the mastoid cells and of the Eustchian tube; it is caused mainly by bacteria, rarely by viruses (7) and typically follows a cold: after a few day of a stuffy nose, the ear becomes involved. Acute otitis media has a rapid onset and is associated with one or more symptoms: pain, fever, otorrhea, irritability, vomiting, diarrhea, anorexia (3). Severity of the disease is based mainly on symptoms. Severe AOM is characterized by severe otalgia and/or a temperature of 39 °C or higher. The pain is caused by the pressure on the tympanic membrane and it is accompanied with different otoscopic findings: bulging, erythema, middle ear effusion (Figs 1–6). It is frequently associated with signs of upper respiratory infections.

Otitis media with effusion (or glue ear, formerly serous otitis media, secretory otitis media) is middle ear effusion of any duration that lacks the associated signs and symptoms of infection, but causes hearing problems. It is important to distinguish AOM, which may benefit modestly from antibiotics, from otitis media with effusion that does not (8). Chronic suppurative OM is a discharge persisting at least 6 weeks and associated with otorrhea through a perforated tympanic mebrane (3).

The progression of acute otitis media is caused by dysfunction of eustachian tube – ET. ET is blocked by edema, tumor, adenoids or negative intratympanic pressure which facilitates spread of infection to the middle ear (3). Viral infection of upper respiratory tract leads to a dysfunction of ET. In children, shorter and more horizontal angle of ET, immature immune system and frequent infections play role in AOM development. The most common bacterial pathogen in AOM is Streptococcus pneumoniae (Fig. 7), followed by Haemophilus influenzae and Moraxella catarrhalis (2, 3, 9, 6).

Other pathogens responsible for AOM are Staphylococcus aureus, Escherichia colli, Klebsiella species and Pseudomonas

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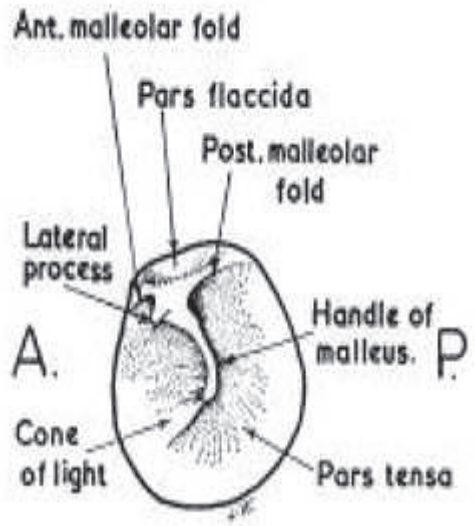
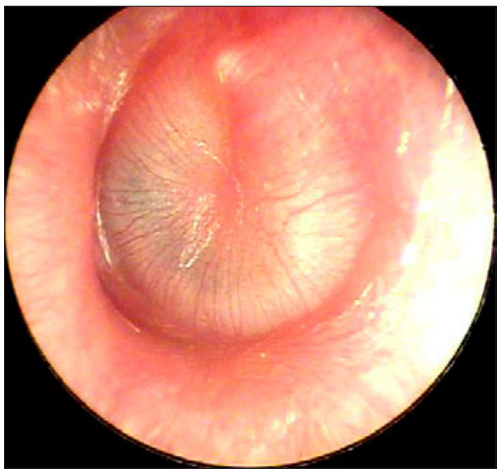
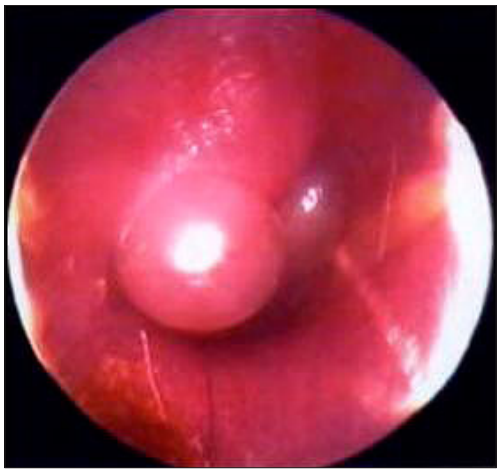
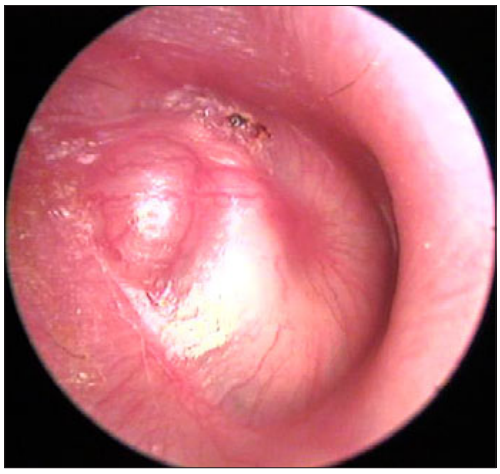


Figs 1 and 2. Tympanic membrane.







Figs 3–6. Tympanic membrane – otitis media acuta.

Fig. 7. Streptococcus pneumoniae.

aeruginosa. Experience from microbiological examinations shows, that positive culture can be found in 58–75 % of cases (6, 9). Acute viral upper respiratory tract infection is a risk factor for AOM development and viruses most commonly associated with AOM are RSV, influenza, parainfluenza virus, rhinovirus and adenovirus. Beside infection factors, host factors contribute to the development of AOM (immune system, familiar predisposition, anatomic abnormality), then factors related to allergies, and environmental factors (feeding, passive smoke exposure, daycare attendance).

The diagnosis of AOM requires: 1) a history of acute onset of signs and symptoms; 2) presence of middle ear effusion, 3) signs and symptoms of middle ear inflammation. 1) Recent, usually abrupt, onset of signs and symptoms of middle ear inflammation and effusion. 2) The presence of middle ear effusion, that is indicated by bulging of tympanic membrane, limited or absent mobility of the tympanic membrane, air fluid level behind the tympanic membrane or otorrhea. 3) Signs and symptoms of inflammation, distinct erythema of the TM, distinct otalgia (5). Clinical history alone is poorly predictive for the presence of AOM, especially in young children (5). Visualization of the TM with identification of MEE and inflammatory changes is necessary. Fullness or bulging of the TM is often present and has the highest predictive value for the presence of MEE. When combined with color and mobility bulging, it is also the best predictor of AOM. The diagnosis of AOM, particularly in infants and young children, is often made with a degree of uncertainty. Common factors that may increase uncertainty include the inability to sufficiently clear the external auditory canal of cerumen or narrow ear canal (5). Laboratory evaluation is usually unnecessary in non severe AOM, but is recommended in severe AOM with fever. The most important laboratory parameters are leukocytes, thrombocytes count and CRP. CT scan of the temporal bone helps to diagnose complications. Other important test to diagnose AOM is tympanometry. Culture and sensitivity test is important especially for the appropriate use of antibiotics. Many episodes of AOM are associated with pain. The management of AOM should include an assessment of pain, it is a strong recommendation based on randomized, clinical trials with limitations and an overweight of benefit over risk (5). Medical management of AOM is actively debated in the medical literature, primarily due to a dramatic increase in AOM prevalence over the past 10 years caused by drug resistant Streptoccocus pneumoniae and beta-lactamase producing H. influenzae or M. catarrhalis. AOM is the most common indication for the prescription of antibiotics. The emergence of multidrug resistant strains, particularly S. pneumoniae, complicates the management and increases the risk for the treatment failure (4). Amoxicillin remains the drug of choice for initial episodes of AOM, although increase of the dosage schedule to 80 mg/kg/day has been recommended (10). Observation without use of antibacterial agents in a child with uncomplicated AOM is an option for selected children based on diagnostic certainty, age, illness severity and assurance of follow-up. It is very important to combine medical treatment with surgical treatment. Tympanocentesis may be performed in ambulant care, but more invasive procedures like insertion of ventilation tubes, adenoidectomy, and surgical treatment of complications need to be done in hospitalized patients. Inpatient care is recommended especially in younger children with severe symptoms, recurrent infection or extracranial or intracranial complications. Antibiotics have produced an overall decline in the frequency of complications of AOM relative to the pre-antibiotic era. The complications of AOM can be following: chronic suppurative otitis media, postauricular abscess, facial nerve paralysis, labyrinthitis, labyrintine fistula, mastoiditis (picture), temporal abscess, petrositis, intracranial abscess, meningitis, otitic hydrocephalus, sigmoid sinus thrombosis, encephalocele (11).

Methods

In our study, we retrospectively reviewed children hospitalized at our ENT Department in Children University Hospital in Bratislava, from January 2005 to December 2006, due to severe acute otitis media. The criteria for admission were severe otalgia, high temperatures of 39 °C or more, dehydration, positive culture of resistant S. pneumoniae, recurrent otitis media, otorrhea, bulging of TM, fluid level behind the tympanic membrane. We evaluated age, gender, etiological agent, resistance to antibiotics. Culture and sensitivity test was made, if possible. We also evaluated laboratory parameters, especially leukocytes count and CRP. CT scan was made, if necessary, which was helpful especially for diagnosing the complications. We focused also on type of used antibiotics, surgical treatment and time of hospitalization. Children with otitis media with effusion or with chronic suppurative otitis media were excluded and we evaluated only patients with acute signs and symptoms of otitis media.

Results

Dduring 2 years, there were 76 children admitted to hospital with severe acute otitis media. The age varied between 4 months

Tab. 1. Age of children.

Age (years)	Number
0 to 1	21
1 to 2	14
2 to 3	12
3 to 4	6
4 to 5	9
5 to 8	7
8 to 14	7
Together	76

Tab. 2. Bacterial pathogens.

S. pneumoniae resistant	25
S. pneumoniae non-resistant	12
H. influenzae	8
S. aureus	4
S. pyogenes	5
M. Catharralis	1
Corynebacterium	1
Negative culture	20

Tab. 3. Used antibiotics.

Cephalosporines gen. 2 and 3	29
Amoxicillin–clavulanate	24
Ciprofloxacin	17
Gentamycin	5
Vankomycin	4
Linkosamid	4
Macrolid	1

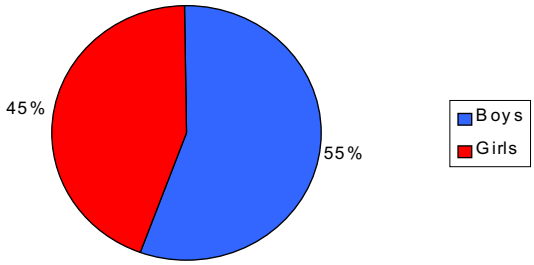


Fig. 8. Incidence according to gender.

Fig. 9. Acute mastoiditis.

to 14 years (Tab. 1). 62 % of children were up to 3 years old. There were 42 boys and 34 girls (Fig. 8) in the group. The most frequent etiological agent was S. pneumoniae, in 48 % of cases, which was in 68 % resistant to penicillin. It was followed by H. influenzae, S. aureus, S. pyogenes and others (Tab. 2).

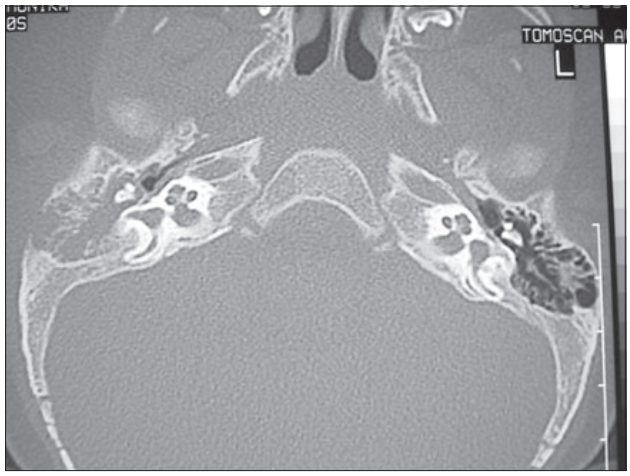
We found negative results almost in 26 % of culture tests. Antibiotics were used according to culture and sensitivity test, if possible, besides negative result and allergy to antibiotics. For the initial treatment of a severe AOM, we started with intravenous antibiotics for at least four days. The most frequently used antibiotics were cephalosporines – cefuroxim axetil, ceftriaxon, and amoxicillin-clavulanate (Tab. 3).

Seven children were admitted to our department with mastoiditis (Fig. 9), 4 times with subperiostal abscess and 3 times without it. One of the patients suffered cerebellitis. Six children underwent a mastoidectomy and one was treated with conservative treatment. Pathogens responsible for these complications were S.pneumoniae, resistant in 2 cases, sensitive to penicillin antibiotics in 1 case. In one case, S. aureus was found and remaining 3 cases had a negative culture test. CT scan was performed in 17 cases to exclude complication (Figs 10 and 11).

Laboratory parameters ranged as follows: leukocytes count from 10 000 to 28 000 and CRP from 57 to 315. As a surgical treatment, tympanostomy was performed in 14 cases, adenoidectomy in 7 cases. The most frequently used surgical method was insertion of ventilation tubes in general anesthesia in 33 patients (Figs 12 and 13). The mean time of hospitalization was 10 days, from 5 to 21 days in patient with intracranial complication.

Discussion

A certain diagnosis of AOM meets all 3 of criteria: rapid onset, presence of MEE, and signs and symptoms of middle-ear inflammation. The clinician should maximize diagnostic strategies, particularly to establish the presence of MEE, and should consider the certainty of diagnosis in determining the management (5). In a child with non-severe AOM, observation can be useful. In opposite, children with severe or recurrent otitis media, with complications, especially younger children, should be admitted to hospital for intravenous antibiotic therapy, management of AOM should include an assessment of pain. Laboratory parameters, CT scans, culture and sensitivity test may help to guide management. Continuous surveillance is necessary to monitor antimicrobial resistance and to guide the antibacterial therapy (12). It is very important to combine medical treatment with surgical treatment. Daily aural toilet is considered to be an



Figs 10 and 11. CT scan, acute mastoiditis.

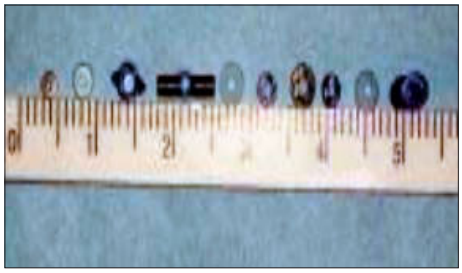


Fig. 12. Types of ventilation tubes.

Fig. 13. Ventilation tube in situ.

important adjunct in eradicating the possible anaerobic component of infection. Microbiological data suggest that only one-third of patients with acute otitis media require the antibacterial therapy for resolution of clinical signs and symptoms (6). It is very important to distinguish AOM from otitis media with effusion, minimizing the use of antibiotics, and discerning between first and second line antibiotics in the treatment of simple uncomplicated versus non-responsive/recurrent AOM (4). There is a wide variation in use of antibiotics between doctors of different nations, from as low as 31 % of cases of AOM in the Netherlands to as high as 98 % in Australia and the United States (1). Antibiotic resistance of pathogens typically causative of AOM continues to increase. The emergence of multidrug-resistant strains, particularly S. pneumoniae, complicate the management of AOM and increase the risk for the treatment failure (4). If medical management fails to prevent new episodes of AOM in children with severe and recurrent disease, placement of tympanostomy tubes and possible adenoidectomy should be considered (10). Placement of ventilation or tympanostomy tubes produce drainage and ventilation of the middle ear and is effective to restore hearing and is now the second most frequent surgical procedure in children, but the criteria for placement of tubes are controversial (6). The prevention of AOM is possible using chemoprofylaxis or vaccines. Pneumococcal disease is a common cause of morbidity and mortality in the pediatric population. The recent emerge of drug resistant strains have provided a strong incentive for preventing pneumococcal infections by vaccination (13). The majority of penicillin-resistant strains are confined to the few same serogroups (14). PNCRM7 (Prevenar) is a pneumococcal vaccine containing seven capsular polysaccharide antigens from the bacterium Streptococcus pneumoniae (4, 6B, 9V, 14, 18C, 19 F and 23F) each of which is conjugated to diphtheria protein (15, 13). Unlike the 23-valent unconjugated pneumococcal vaccines, PNCRM7 elicits T cell-dependent response and thus protects young children against pneumococcal disease. PNCRM7 vaccine will be of great benefit to those societies that have implemented active immunization programs and the vaccine has the potential to reduce the mortality and morbidity rates associated with S. pneumoniae (15). An increasing worldwide bacterial resistance to antimicrobial agents is forcing us to prescribe antibiotics more rationally (16). Oral amoxicillin

should remain the first line antimicrobial agent for treating AOM, dosage of 80 to 90 mg/kg/day is recommended. For patients with clinically defined treatment failure after 3 days of therapy, useful alternative agents include oral amoxicillin-clavulanate, cefuroxime axetil or ceftriaxon (17). Appropriate use of antibiotics is a major issue in today's medicine. At present, there is no proven method to identify which case of AOM requires antibiotics to improve and which case will improve spontaneously. General practitioners in the Netherlands have proposed a delaying treatment of AOM for the initial 3 or 4 days to identify children who do not improve spontaneously (2). Currently there are new guidelines to modify the treatment of AOM (2). Despite a general agreement, wide differences in the treatment of uncomplicated AOM in children are observed. Non-antibiotic therapy for AOM and the use of first-choice antibiotics should be more actively encouraged in the primary care centers (18). Younger children with severe disease, especially those colonized with pathogens, should be treated with antibiotics (2). Actual management of each patient depends on clinical judgment, the severity of the illness, access to adequate follow up care and other features.

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