Ref: Ro J Pediatr. 2019;68(3)
DOI: 10.37897/RJP.2019.3.1

ACUTE OTITIS MEDIA IN PEDIATRIC PRACTICE: UPDATE

Prof. Doina Anca Plesca, MD, PhD
"Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

ABSTRACT

Acute otitis media (AOM) is one of the most common infections in childhood. It is considered the main cause of prescribing antibiotics in pediatrics. Physicians tend to overdiagnose this disease leading to an unnecessary antibiotics prescription which exposes the child to an unwanted side effects, mainly diarrhea.
Diagnosis is routinely based on symptoms and otoscopy findings. A diagnosis of AOM should be considered in any young child who presents with irritability, lethargy, otorrhoea and fever with or without localized ear pain.
Distinguishing between AOM and otitis media with effusion (OME) is important. OME is more common than AOM.
Primary treatment is aimed at reducing pain. Symptoms in isolated, unilateral AOM usually resolves after 2 days without antibiotic treatment. Always consider the possibility of sepsis in an ill child with fever.

Keywords: acute otitis media (AOM), child, infections, anti-inflammatory, analgesic

INTRODUCTION

Respiratory tract infections (RTIs) are one of the leading causes of morbidity and mortality worldwide in both children and adults (1,2). In developed countries, about 50% of consultations are respiratory tract diseases. RTIs are produced by various etiological agents (viruses, bacteria, fungi, protozoa etc.) that can affect the upper and / or lower respiratory tract. Most often, the evolution of these infections is benign, self-limiting and easy to treat. There are situations in which the clinical evolution is severe (acute community pneumonia, acute bronchiolitis, bronchitis etc.) and may be followed by the formation of important sequelae lung lesions, all of which require a sustained and long-term therapeutic approach.

Most of the time, ITRs have a recurring character, so that, during a year, several episodes of illness can occur. The frequency of respiratory infections varies according to the age of the patient. In the first years (0-6 years), acute upper respiratory infections have a frequency of 6-8 episodes / year. If children attend a community (nursery, kindergarten, school etc.), the number of these episodes may increase. In contrast, acute lower respiratory infections are rarer, more severe, often require hospitalization and, by implication, require high costs for medical care. It is estimated that in developed countries, approximately 6% of children under 6 years have recurrent RTIs. The age structure of recurrent BTIs occurring in childhood shows that 25% of episodes occur in children under one year of age and 18% occur in children aged 1 to 4 years (3).

After upper respiratory tract infections, acute otitis media (OMA) is the most common condition for which medical attention is required (Philip Fierman, 2003). In addition, it is considered the most common bacterial infection in infants and young children, with an incidence peak between 6 and 11 months.

It is estimated that 80% of children will have an episode of AOM in the first 3 years and 30% will have 2 or more episodes, while 25% of infants will have more than 3 episodes / year.

Acute otitis media is the acute inflammation, usually purulent, of the middle ear, produced by an infectious pathogen (bacteria, viruses, viruses, bacterial infections), which penetrates through the Eustachian tube in the middle ear. The disease begins suddenly with the presence of signs and symptoms of inflammation, such as otalgia and fever.

FACILITATING FACTORS

The most important factors are:

– Increased susceptibility to acute respiratory infections (RTIs) (5). One in 3 children with

Corresponding author:
Prof. Doina Anca Pleşca, MD, PhD, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania
E-mail: doinaplesca@yahoo.com

higher ITR will develop AOM and 94% of previous ITR AOM (7);
- The anatomical peculiarities of Eustachian tube in infants and young children (short, horizontal, wide, low muscle tone, elements prone to obstruction) (5,8);
- Anatomical features of the cranial massif;
- Gastro-oesophageal reflux;
- Feeding the baby in the lying position;
- Use of the pacifier (6,8);
- Passive smoking (6,8);
- Attendance of the community (6,9);
- Immune immaturity (reduced synthesis of antibodies)

Table 1 shows the favoring factors responsible for the production of acute otitis media (17).

TABLE 1. *AOM facilitating factors*

Facilitating factors
Infectious: acute rhinopharyngitis, acute or chronic rhinosinusitis
Mechanical and inflammatory: adenoid vegetation, benign or malignant tumors of the nostrils, deviation of nasal septum
Mechanical: palatoschizis
Traumatic: adenoidectomy, anterior and posterior tamponade of the nasal passages, tympanic perforations
General: infectious and contagious diseases (influenza, measles, rubella, varicella, scarlet fever), allergy, pneumonia / bronchopneumonia
Others: cold, humidity, sudden temperature changes, breastfeeding

ETIOLOGY

Medium (suppurated) acute otitis is defined as an inflammatory reaction that occurs in the middle ear secondary to acute upper respiratory infection. In children, the anatomical features of Eustachio's tube favor the more frequent occurrence of the infection. The etiology of AOM can be varied: bacterial, viral or mixed (viral-bacterial).

Table 2 illustrates the most common etiology found in AOM (9,11,14).

TABLE 2. *Bacterial etiology of AOM (after Institut National d'excellence en santé et en services sociaux, Quebec, 2016)*

The most common bacterial etiology
Streptococcus pneumoniae (40-50%)
Haemophilus influenzae (30-40%)
Moraxella catarrhalis (10-20%)
Staphylococcus pyogenes and *Staphylococcus aureus* (10-20%)
Streptococcus pyogenes

DIAGNOSIS CRITERIA

The defining elements for the positive diagnosis of acute otitis media (AOM) are the following (8,11):
- Acute onset (fever, general condition alteration, food refusal etc.);
- The presence of exudate in the middle ear;
- Signs and symptoms of inflammation of the middle ear (otalgia, erythema of the tympanic membrane etc.);

The signs and symptoms most commonly found in the child with AOM are also shown in table 3:
- High fever, lethargy, irritability, anorexia
- Crying, unconsolated screams;
- Severe and pulsatile otalgia started suddenly;
- Ear ache, headache, signs / symptoms of high respiratory infection;
- Vertigo, hearing loss may occur in the older child.

TABLE 3. *AOM associated signs and symptoms*

Cephalic extremity signs and symptoms	General signs and symptoms	Other signs
Otalgia *Otorrhea* *Headache* *Signs/symptoms of IACRS*	*Fever* *Irritability* *Lethargy* *Anorexia* *Nausea/Vomiting* *Diarrhea*	*Vertigo* *Hearing loss*

Positive diagnosis

Clinical diagnosis of AOM implies the presence of the following clinical elements (9,14):
- acute onset, within the first 24-48 hours;
- red and convex eardrum on otoscopic examination;
- liquid accumulation in the middle ear.

Isolated eardrum congestion is NOT suggestive for OMA. This can be caused by various other causes such as: fever, crying, trauma, acute upper respiratory infections.

The most important procedure for confirming AOM is the otoscopic examination (8,10,14,17). At the otoscopic examination we can detect alterations of the eardrum with particular histological changes at the different evolution stages:

– **congestive phase** (17): the eardrum is hyperemic around the hammer handle, then all over the *pars tensa*;

– **exudative phase** (17): the eardrum is matte, with the Politzer light cone modified or missing, sometimes through the transparency of the eardrum a level of liquid or air bubbles can be seen; the mobility of the eardrum is reduced. After the appearance of the suppuration in the middle ear, the eardrum becomes intensely congestive, bulging, thickened, with the loss of the classic anatomical landmarks. In evolution, the eardrum perforates most often in the lower quadrants, and the external auditory duct is initially filled with

serous secretions, then mucopurulent. After aspiration of the secretions from the duct, the eardrum perforation can be observed;

Other procedures to confirm the positive diagnosis are: otomicroscopic examination, naso-pharyngeal endoscopy, microbiological examination of the secretions collected, Schüller incidence radiographs, tympanogram (10) etc.

Differential diagnosis

In front of a child with signs and symptoms of AOM, a differential diagnosis is required. The most common clinical entities that are discussed are:

1. **External otitis**, which is an infection of the external auditory canal.

2. **Serous otitis media** is a clinical entity commonly found in pediatric pathology. It is characterized by the accumulation of abacterial fluid in the middle ear. In the absence of inflammation, the most common is asymptomatic. It may occur in the context of an acute respiratory infection that causes Eustachio's tube dysfunction or after resolution of an AOM episode (10).

3. **Recurrent otitis media** is defined as repeated episodes of AOM (≥ 3 episodes of AOM in 6 months with evidence of healing between episodes or ≥ 4 episodes of AOM in 12 months) (9).

By the age of 7, approximately 40% of children have ≥ 6 episodes of AOM.

Other conditions with skull localization may have a similar clinical picture of AOM. Of these, I mention: chronic re-acute otitis media, some dental disorders, disorders of the temporomandibular joint etc.

TREATMENT

AOM treatment is complex (6,8,9). It consists of pain therapy, anti-infectious therapy, surgical methods, to which are added prophylactic methods (pneumococcal vaccination etc.).

AOM is a medical condition associated with significant pain (9,14). In this situation, pain treatment should be initiated as soon as possible, regardless of whether or not the pediatric patient receives antibiotic therapy. Oral / intrarectal administration of analgesics should be initiated as soon as possible (within the first 24 hours after the symptomatology onset) to reduce the child's suffering. The medication used is analgesics / antipyretics. These include: ibuprofen 10 mg/kgc/dose (max. 400 mg) administered *per os* at 6-8 hours and / or acetaminophen / paracetamol given to infants after 3 months, at doses of 15 mg/kg/dose *per os*, at 6 hours (15).

Both acetaminophen and ibuprofen are effective in reducing pain in children with AOM (9). This assertion is based on a meta-analysis undertaken on randomized and controlled trials (Sjoukes et al., 2016). In the same meta-analysis, no significant differences were identified between the two products in terms of pain reduction. The combined use of the two drugs was not superior to the use of only one product (9).

The use of local topical analgesic substances as drops significantly increases the number of patients whose pain was reduced after administration (9).

According to the latest published guidelines (9), nasal decongestants and anti-histamines used as monotherapy or in combination therapy have not been shown to improve the symptoms of AOM.

AOM is a self-limiting infection of the middle ear. This is caused by viruses and/or bacteria that can sometimes be present concomitantly. In most children, AOM is resolved without antibiotic treatment (9).

Most children with unilateral, isolated AOM do not require antibiotic therapy (9,17).

The initiation of antibiotic therapy is recommended for all children with severe systemic signs and symptoms such as hyperthermia, vomiting, lethargy, food refusal.

The following categories of pediatric patients require the initiation of antibiotic therapy (14):

- Infants under 6 months
- Children under 2 years with bilateral AOM
- Symptoms that last for over 48 hours
- Temporal perforation (otorrhea, visualization of the temporal perforation)
- Immunodepressed children

Table 4 illustrates the therapeutic approaches in OMA, according to age (14).

TABLE 4. *Therapeutic recommendations according to age*

Age	Initial therapeutic recommendations
< 2 months	Mandatory hospitalization Pain management Timpanocentesis and bacterial secretions culture Ceftriaxone of amoxiciline-clavulanic acid in standard doses
Between 2 and 6 months	Amoxiciline- clavulanic acid in large doses, for 10 days
More than 6 months	if it is not a serious condition, the patient will be monitored for 48-72 hours First treatment line - amoxiciline 80-90 mg/kg, 7-10 days Pain management using analgesics Amoxiciline-clavulanic acid in presence of severe signs of illness or in case of history of previous antibiotic use

If there is no response to the initial therapy, the following approach is recommended (table 5) (8,9,14,15).

TABLE 5. *Therapeutic recommendations after the failure of the first treatment schedule*

Initial therapy	Amoxiciline 80-90 mg/kg/day Pain management using analgesics
If previously the patient received antibiotic therapy	Amoxiciline-clavulanic acid: 90 mg/kg/ day amoxiciline & 6,4 mg/kg/zi clavulanic acid, 2 times/day during 5-10 days. Pain management using analgesics
No response after 48-72 hours using pharmacological treatment	Ceftriaxone Timpanocentesis Pain management using analgesics

In most cases, acute otitis media occurs due to viral infection of the upper respiratory tract, so it is considered that, for 24-48 hours, the initiation of antibiotic treatment to be delayed. Following trials conducted in recent years, it was observed that in infants and children between 6 months and 10 years of age who showed no signs of severe illness (moderate / medium otalgia, fever below 39 °C, congestive eardrum without bolging) and to whom has not been started antibiotic treatment since the symptomatology beginning, 67% of them no longer needed antibiotic therapy (8,14,15).

In children under 6 months of age or with signs of severe illness (medium/severe otalgia, fever above 39 °C, very congestive eardrum, without anatomical landmarks), antibiotic treatment is instituted (14,15). As currently approved therapeutic variants, we specify:

- Amoxicilline *per os* 80-90 mg/kgc/day;
- Clarithromycin, azithromycin, erythromycin *per os*;
- Cephalosporins: cefuroxime (30 mg/kgc/ day), ceftriaxone (30-50 mg/kg/day); cefdinir *per os* (15 mg/kgc/day);

The duration of antibiotic treatment is variable. Thus, for children in the first 2 years, therapy lasts 10 days, while for children over 2 years, therapy is 7-10 days. In case of failure of antibiotic therapy, surgery is performed (tympanotomy). Table 6 illustrates the recommendations regarding the duration of antibiotic therapy according to the severity of the disease and the patient age (16).

TABLE 6. *Duration of antibiotic therapy depending on the severity and patient age*

	Oral AB recommendation	Ceftriaxone
Severe AOM	0-18 years – 10 days	3 days
	< 2 years – 10 days	
Mild/medium AOM	2-5 years –7 days	3 days
	More than 5 years – 7 days	

Nasal decongestants and anti-histamines are not recommended; there are no demonstrated clinical benefits.

The surgical methods consist of myringotomy, adenoidectomy, antrostomy / mastoidectomy.

Miringotomy (7,10,14,17) is indicated when there is no response to antibiotic treatment, manifested by persistence of otalgia and fever after 48-72 hours. It is a surgery under sterile conditions and is performed under general anesthesia. The incision of the tympanic membrane is made in the antero-inferior quadrant and must be parallel to the radial fibers in the *pars tensa* with the aspiration of secretions. In order to avoid the rapid cicatrization of the incision, a transtimpanal aerator tube is placed.

Adenoidectomy (9,17) is indicated in recurrent / recurrent otitis media.

Antrostomy / mastoidectomy (9,17) is indicated when the presence of a complication (otomastoiditis) is suspected.

In children under 2 years of age vaccinated with influenza vaccine, was observed a reduction in the incidence of AOM in the cold season, by about 30%.

COMPLICATIONS

The infection of the middle ear can spread, sometimes causing intra- and extracranial complications. Among the intracranial complications we mention brain abscess, acute meningitis, subdural empyema, septicemia. Extracranial complications are acute mastoiditis (1-4 / 100,000 population, EU, Canada, Australia, USA, 0.3 / 100,000 Denmark (7); 6.0 / 100,000 Israel (8); 3.8 / 100,000 Holland (9)), facial paralysis, acute labyrinthitis.

Long term complications were cited such as: hearing loss, delayed language / speech development, low socialization skills, eardrum perforation.

MONITORING

Most cases of AOM are self-limiting (14,16). After resolution of the signs and symptoms and treatment stopping, patients will be re-evaluated at 4-6 weeks by the primary care physician to prevent the persistence of serous otitis media.

Patients whose symptoms such as pain and fever do not remit within 48-72 hours of treatment will be re-evaluated by the ENT specialist (16).

Patients with persistent symptomatology or recurrent AOM will be re-evaluated by an ENT specialist for eventual tympanocentesis. If after the initiation of antibiotic therapy the condition of the patient does not improve, the antibiotic should be changed (16).

REFERENCES

1. Williams BG, Gouws E, Boschi-Pinto C et al. Estimates of world-wide distribution of child deaths from acute respiratory infections. *Lancet Infect Dis,* 2002;2:25–32.
2. Kvaerner KJ, Nafstad P, Jaakkola J. Upper respiratory morbidity in preschool children: A cross-sectional study. *Arch Otolaryngol Head Neck Surg,* 2000; 126:1201–6.
3. Bellanti JA. Recurrent respiratory tract infections in paediatric patients. *Drugs,* 1997; 54 Suppl 1:1–4.
4. Agence française de securité sanitaire de produits de Robinsonsante, oct 2015. Revue de la Societé de pathologie infectieuse de langue française vol.35, nr.12, dec 2015, p.566-577.
5. Easton J et al. Amoxicillin/clavulanic acid – a review of its use in the management of paediatric patients with AOM. *Drugs* 2003; 63(3):311-340.
6. Gisselsson-Solen M. Acute otitis media in children – current treatment and prevention. *Curr Infect Dis Rep.* 2015 May; 17(5):476.
7. Ma'in Al Shawabkeh, Hassan Haidar, Aisha Larem, Zahraa Aboul-Mahmood, Ali Alsaadi, Abdulsalam Alqahtani. Acute Otitis Media – An Update. Journal of Otolaryngology-ENT Research, Volume 8 - Issue 4, 2017, pg.1-6.
8. American Academy of Pediatrics: Subcommittee on Management of Acute Otitis Media. (2013). Diagnosis and management of acute otitis media. *Pediatrics,* Vol. 113 (5): pp.1451-1465.
9. Otitis media (acute): Antimicrobial prescribing, NICE 2018.
10. Leskinen K, Jero J. Complications of acute otitis media in children in southern Finland. I*nt J Pediatr Otorhinolaryngol.* 2004 Mar; 68(3):317-24.
11. Melissa K Van Dyke et al. Etiology of Acute Otitis Media in Children Less Than 5 Years of Age. The Pediatric Infectious Disease Journal, Volume 36, Number 3, March 2017, 271-281.
12. Jarold L Cosby, Nick Francis, Christopher C Butler. The role of evidence in the decline of antibiotic use for common respiratory infections in primary care. *The Lancet Infectious Diseases,* vol. 7, issue 11, pg 749-756.
13. La Saux N, Robinson JL. La prise en change de l'otite moyenne aigue chez les enfants de six mois et plus. *Paediatric Child Health* 2016;21 (1):45-50.
14. Children's Health Queensland Hospital and Health Service. Acute otitis media – emergency management in children 2018.
15. Pediatric Acute Otitis Media (Ear Infection) Care Process Model June 2019 Update.
16. Brenda L Natal et al. Emergent Management of Acute Otitis Media. Medscape, June 2019.
17. R. Hainăroşie, Doina Anca Pleşca, în Protocoale de diagnostic şi tratament în pediatrie, coord. Doina Anca Pleşca, Editura Amaltea, 2019, 79-88, ISBN 978-973-162-195-1.