

Otitis Media

Otitis media is the most common bacterial infection occurring in children, and it is the most commonly diagnosed illness in childhood. This infection occurs in half of all infants before their first birthday and in 80% by their third birthday. Half of all infected children will have 3 or more episodes in their first 3 years of life.

I. Pathophysiology

- A. Otitis media is classified as either acute otitis media or otitis media with effusion.
- B. **Acute Otitis Media** consists of inflammation of the middle ear, presenting with a rapid onset of symptoms and clinical signs of ear pathology. Fever and ear pain are the most common acute symptoms. Irritability, anorexia, vomiting, and diarrhea may also be present.
 - 1. Acute otitis media is most common in children 6 months to 3 years. The majority of children have had at least one episode of acute otitis by age 3. It is uncommon after age 8. The incidence rises during winter and falls during summer.
 - 2. **Predisposing Factors for Otitis Media**
 - a. **Biologic Factors.** Adenoid hypertrophy, male gender, family history, congenital anomalies (cleft palate), prematurity, and low birth weight.
 - b. **Environmental Factors.** Exposure to passive smoke, frequent upper respiratory infections.
 - 3. **Pathophysiology**
 - a. Viral infection or allergic responses may cause changes in the eustachian tube and middle ear that predispose to bacterial infection.
 - b. The first episode of otitis media usually occurs after 6 months of age, with the loss of maternal antibody protection.
- C. **Otitis media with effusion** consists of a chronic bacterial infection persisting more than 2 weeks manifesting as an asymptomatic middle-ear effusion. The syndrome usually develops after an acute otitis media.

II. Microbiology

- A. **Common Pathogens.** The most common bacterial pathogen in all age groups is *Streptococcus pneumoniae*, causing 40% of effusions. The next most common is non-typable *Haemophilus influenzae*, causing 20% of effusions. Anaerobic bacteria, *Chlamydia* or *Mycoplasma* cause less than 2-5%.
- B. **Drug Resistance.** Ampicillin resistance caused by beta-lactamase occurs in 30-50% of *H. influenzae* and up to 80% of *M. catarrhalis*.

C. **Penicillin-resistant S. Pneumoniae** results from bacterial alterations in penicillin-binding proteins, rather than beta-lactamase. Highly resistant strains are resistant to penicillin, trimethoprim-sulfamethoxazole (TMP-SMX), and third-generation cephalosporins. The prevalence of multiple-drug resistant *S. pneumoniae* is 20-35%.

III. Diagnosis

A. Acute Otitis Media

1. The position, color, translucency and mobility of the tympanic membrane should be assessed. The normal eardrum is translucent and landmarks should be visible through the eardrum. A cloudy opacified tympanic membrane in children is often associated with middle ear effusion.
2. Erythema of the eardrum alone is often the result of a viral infection or crying. Retracting the pinna superiorly and laterally, facilitates examination of the ears of younger children.
3. Reduced or absent mobility of the tympanic membrane with air insufflation is the most specific sign of acute otitis media.
4. The tympanic membrane is dull and bulges externally, losing its concave contour and light reflex. The tympanic membrane may be red or yellow with obscured bony landmarks. An air-fluid level or air bubbles may sometimes be visualized behind the tympanic membrane. If the membrane has perforated, a purulent exudate may be seen in the external canal.
5. Bullous myringitis, associated with *Mycoplasma* and viral infections, presents with large, brown, hemorrhagic bullae on the tympanic membrane.

B. Otitis Media with Effusion

1. In the absence of symptoms or signs of acute illness, evidence of middle ear inflammation indicates that an otitis media with effusion is present. Typical findings include diminished tympanic membrane mobility and visualization of air-fluid levels.
2. The sensation of fullness in the ear or obvious hearing loss may be present.

IV. Treatment of Acute Otitis Media

A. First-line Antibiotics

1. Oral antibiotics should be prescribed for 10-14 days.
2. **Amoxicillin** is the standard initial treatment for acute otitis media; 40 mg/kg/day in divided doses q8h, or 500 mg tid in adults. Amoxicillin has high efficacy, low cost, and tolerability. Alternative drugs may be indicated in communities with a high rate of resistant *H. influenzae* and *M. catarrhalis*.
3. **Trimethoprim/sulfamethoxazole (Bactrim, Septra)** 8-10 mg/kg/day in divided doses bid, provides reasonable coverage for *S. pneumoniae* and *H. influenzae*, but it is not effective against *S. pyogenes* (the cause of streptococcal pharyngitis); toxic reactions

include Stevens-Johnson syndrome, renal tubular acidosis, and rash. It is useful for penicillin allergic patients

4. **Erythromycin/sulfisoxazole (Pediazole)** coverage includes H. influenzae and other common pathogens; 50 mg/kg of erythromycin component in 4 divided doses qid; it may cause gastric upset and bone marrow suppression.

First-Line Antibiotic Therapy for Acute Otitis Media

Drug	Dosage	Comments
Amoxicillin	40 mg/kg in 3 divided doses	Most commonly used initial drug
Erythromycin-sulfisoxazole (Pediazole)	50 mg/kg erythromycin + 150 mg/kg sulfisoxazole in 3 or 4 divided doses	GI intolerance common. Not for use in infants <2 months. Rarely, Stevens-Johnson syndrome
Trimethoprim-sulfamethoxazole (Bactrim, Septra)	8 mg/kg trimethoprim + 40 mg/kg sulfamethoxazole in 2 divided doses	Not for use in infants <2 months. Rarely, Stevens-Johnson syndrome and myelosuppression

B. Refractory Acute Otitis Media.

1. Treatment failure is seen in about 10% of cases. Second line agent may be used in patients who do not improve within a two days of treatment, or if eardrums are still inflamed at 2-4 weeks follow-up.
2. **Oral Cephalosporins** cover beta-lactamase-producing, ampicillin-resistant organisms.
 - a. **Cefuroxime axetil (Ceftin)**. <2 y: 125 mg PO bid; 2-12 yrs: 250 mg PO bid **OR** >12 yrs: 250-500 mg PO bid.
 - b. **Cefixime (Suprax)**. 200 mg bid or 400 mg qd; pneumococcus response rate is lower than with other agents.
3. **Amoxicillin/clavulanate (Augmentin)** is useful in settings where beta-lactamase organisms are common. 40 mg/kg/day in divided doses q8h.
4. **Loracarbef (Lorabid)**. 30 mg/kg in 2 divided doses (max 800 mg) in children 6 months to 12 years; 200-400 mg bid in adults [200 mg].

Second-Line Antibiotic Therapy for Acute Otitis Media

Drug	Dosage	Comments
Amoxicillin-clavulanic acid (Augmentin)	40 mg/kg of amoxicillin component in 3 divided doses	Diarrhea common
Cefixime (Suprax)	8 mg/kg in 1 or 2 divided doses	Once-daily oral therapy
Cefpodoxime proxetil (Vantin)	10 mg/kg in 2 divided doses	
Cefprozil (Cefzil)	30 mg/kg in 2 divided doses	
Cefuroxime axetil (Ceftin)	500 mg in 2 divided doses	
Loracarbef (Lorabid)	30 mg/kg in 2 doses	
Amoxicillin-Clavulanate + Amoxicillin	Amoxicillin-clavulanate 40 mg/kg of amoxicillin component in 3 divided doses; amoxicillin 40 mg/kg in 3 divided doses	
Clindamycin	10 mg/kg/d in 3 or 4 divided doses	

C. Patients whose symptoms continue following initiation of a second antibiotic and who have evidence of persistent otitis media on examination are candidates for tympanocentesis.

D. **Penicillin-resistant S. Pneumoniae.** Highly resistant strains are resistant to penicillin, trimethoprim-sulfamethoxazole (TMP-SMX), and third-generation cephalosporins. The prevalence of multiple-drug resistant *S. pneumoniae* is 20-35% High dose amoxicillin (80 mg/kg/d), or amoxicillin plus amoxicillin/clavulanate, clindamycin, or vancomycin are therapeutic options.

E. Prophylactic Therapy

1. Indications for prophylactic therapy include 3 or more episodes of acute otitis media within a 6 month period or 4 episodes within 12 months. Prophylaxis may be initiated at the onset of upper respiratory infection symptoms or given continuously throughout the winter months.
2. Amoxicillin, 20 mg/kg qd or
3. Sulfisoxazole (Gantrisin), 75 mg/kg qd at bedtime or
4. Trimethoprim-sulfamethoxazole (Bactrim) 5 mg/kg qhs.

V. Treatment of Otitis Media with Effusion

- A. Middle ear effusions are associated with a significant hearing loss and may result in delayed speech or language development.
- B. Myringotomy and tube placement may be used for otitis media with effusion in children with bilateral effusions persisting for longer than 90 days with hearing loss, and for children with recurrent otitis media (3 episodes in 6 months or 4 episodes in 1 year).

VI. Adjunctive Therapies for Otitis Media

A. Analgesia. Analgesia is often necessary during the first 24 hours after initiation of therapy. Acetaminophen or ibuprofen suspensions are often effective. A topical analgesic-anesthetic combination such as antipyrine and benzocaine solution (Auralgan, instill in ear q2h) may be helpful but should be avoided if the tympanic membrane is perforated.

VII. Complications

- A. The most common complications of otitis media are hearing loss and perforation of the tympanic membrane (which usually heals spontaneously). The most common infectious complication is mastoiditis, which is suggested by tenderness over the mastoid process and by clouding on plain radiographs or CT.
- B. Cholesteatoma, meningitis, brain abscess, subdural empyema, lateral venous sinus thrombosis, and facial nerve injury are rare complications. §