

Diagnosing and Managing EYE AND EAR INFECTIONS



A Practical Guide for Nurse Practitioners and Physician Assistants

FACULTY

Wayne E. Berryhill, MD

Leonard Bielory, MD

Mark P. Christiansen, PA-C, PhD

Susan Tiso, MN, FNP-BC

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This program was planned in accordance with AAPA's CME Standards for Enduring Material Programs and for Commercial Support of Enduring Material Programs.

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Activity Goal

To help nurse practitioners and physician assistants in primary care readily recognize the signs and symptoms of common eye and ear infections, and to familiarize them with guideline-recommended management protocols so they may develop treatment plans that minimize recovery time and reduce the risk of recurrence.

Learning Objectives

After completing this activity, participants should be better able to:

- Differentiate the symptoms of bacterial, viral, and allergic conjunctivitis while identifying symptoms of secondary causes
- Select appropriate treatment options for bacterial, viral, and allergic conjunctivitis
- Describe the presentations and diagnostic criteria for the detection of acute otitis media, otitis media with effusion, and otitis externa
- Initiate appropriate treatment for patients with acute otitis media, otitis media with effusion, and otitis externa based on current guidelines

Faculty

Wayne E. Berryhill, MD

Assistant Professor of Otolaryngology
The University of Oklahoma
Health Sciences Center
Oklahoma City, Oklahoma

Leonard Bielory, MD

Professor
Center for Environmental Prediction
Rutgers University
Director
STARx Allergy and Asthma Center, LLC
Medicine, Pediatrics, Ophthalmology
and Visual Sciences
Springfield, New Jersey

Mark P. Christiansen, PA-C, PhD

Associate Director
Division of Physician Assistant Education
School of Allied Health Professions
College of Medicine
University of Nebraska Medical Center
Omaha, Nebraska

Susan Tiso, MN, FNP-BC

Associate Clinical Professor
Program in Nursing Science
College of Health Sciences
University of California, Irvine
Irvine, California

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Dr Christiansen has nothing to disclose with regard to commercial interests.

Ms Tiso has nothing to disclose with regard to commercial interests.

The Planning Committee for this activity included Catherine A. Bevil, RN, EdD, and Robert Schmida, of the University of Nebraska Medical Center College of Nursing Continuing Nursing Education; and Ruth Cohen and Grace Halsey of Continuing Education Alliance. The members of the Planning Committee have no significant relationships to disclose.

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The information in this guide on pharmacologic management of patients with eye and ear infections is based on the most recent manufacturers' prescribing information available at the time of publication. This guide should not be considered a comprehensive drug reference.

DIAGNOSING AND MANAGING EYE AND EAR INFECTIONS:

A Practical Guide for Nurse Practitioners and Physician Assistants

INTRODUCTION

Eye and ear infections are 2 of the most common presentations in primary care that place nurse practitioners and physician assistants on the front lines of timely diagnosis and effective management. While the body structures involved are small, the impact of disease and treatment in the United States is significant:

- In 2005, the annual incidence of bacterial conjunctivitis alone was estimated at \$4 million; annual cost, including lost productivity, is estimated at \$589 million¹
- Ocular allergies affect more than 20% of the US population; annual cost (including allergic rhinitis) is estimated at nearly \$6 billion²
- Ocular prescription medication costs have risen in the past decade from \$6 million (2002) to over \$1

billion (2010)²

- Acute otitis media is the most common infection for which children in the United States receive antibiotics³
- Otitis media with effusion occurs in about 2.2 million persons each year; most are children⁴
- Untreated or mismanaged otitis can lead to developmental disabilities, learning difficulties, and impaired hearing in young children⁴
- Untreated otitis externa can lead to malignant otitis externa, a life-threatening condition⁵

Careful evaluation and rapid and specific intervention, where indicated, are essential for patients who present with red eye or otitis, particularly children.

This guide is designed to be a quick and convenient reference. While not

exhaustive, the content is presented to help maximize examination time, develop an accurate diagnosis, and move quickly toward treatment and resolution.

In each section there are short comments from our nurse practitioner and physician assistant faculty. Mark Christiansen, PA-C, PhD, and Susan Tiso, MN, FNP-BC, offer practical tips for conjunctivitis and otitis, respectively, from their own experience in primary care that may help you when assessing and treating patients with eye and ear infections.

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Part I: CONJUNCTIVITIS

OVERVIEW

Conjunctivitis, often called “red eye” or “pink eye,” is a general term that describes inflammation of the conjunctiva. This is one of the most common eye conditions, with an estimated annual incidence of 4 million cases in the United States in 2005.¹ Conjunctivitis usually results either from allergy or from bacterial, viral, or chlamydial infection. Other common types of conjunctivitis are related to dry eye, trauma, mechanical insult, blepharitis, toxins, or contact lenses. Conjunctivitis can also occur secondarily to systemic disease. Risk factors are nonspecific and are generally related to the underlying cause.

Management varies with the cause of the irritation. Most patients with conjunctivitis are treated on an outpatient basis, although infants with neonatal conjunctivitis may require hospitalization.¹ While primary conjunctivitis is often self-limited, treatment shortens the course of the condition, decreases the amount of time the patient is contagious, provides symptom relief, and may delay or prevent complications. The condition also merits serious attention because vision loss is possible.

CLINICAL EVALUATION

Patient Presentation

Conjunctivitis typically presents with inflammation accompanied by hyperemia and ocular discharge (Figure 1). The nature of the discharge provides immediate clues to the type of conjunctivitis (Table 1). If itching is present, allergy is likely. Itching can be mild or severe, but its absence generally eliminates allergy from the differential. Pain is usually absent to mild, except in cases of hyperacute bacterial conjunctivitis or chemical burn.



Figure 1. Clear to opaque ocular discharge associated with allergic conjunctivitis.

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History and Examination

Although conjunctivitis has many causes, most cases can be diagnosed on the basis of the history and eye examination. A detailed history is the most important step in the differential diagnosis and includes questions about symptoms, ocular health, and general health as well as personal social history and family ocular and medical history. Table 2 provides suggested components of a history for patients with conjunctivitis.¹

Ocular Examination

The examination should include the relevant elements of a comprehensive general eye examination, beginning with documentation of baseline corrected visual

acuity. Inspect all aspects of the external eye and regional structures, including surrounding skin, skin of eyelids, eyelashes, and the eyeball. External observation of the conjunctiva, sclera, cornea, and iris should also be documented. While slit-lamp biomicroscopy of the cornea is optimal, many important clinical features are apparent to the naked eye, or with use of a penlight or hand-held direct ophthalmoscope. Use of convex (plus) and concave (minus) lenses on the ophthalmoscope can provide desired magnification. An ophthalmoscopic head with a cobalt blue filter will highlight corneal and conjunctival anomalies after fluorescein staining.² The instrument-assisted examination of the

Table 1. OCULAR DISCHARGE PROVIDES CLUES TO DIAGNOSIS

Type	Possible Causes	Nature of Discharge		
		Serous (watery)	Mucoid (stringy)	Mucopurulent
Allergic	Allergens: mold, dust, spores, pollen, etc.	++	+	
Bacterial	Most common: <i>Streptococcus</i> , <i>Staphylococcus</i> , <i>Haemophilus</i> , <i>Pseudomonas</i> , <i>Moraxella</i>		+	+
Hyperacute bacterial	<i>Neisseria gonorrhoeae</i>			+++ (copious)
Viral	<i>Adenovirus</i> , <i>Herpes simplex</i> , <i>Varicella-zoster</i>	+	+	
Chlamydial	<i>Chlamydia</i>			+
Toxin	Dry cement mix, chemicals, etc.	+	+	+
Other	Dry eye, corneal abrasion, foreign body	+	+	+

American Optometric Association.¹

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anterior portion of the eye is used to evaluate eyelids, conjunctiva, cornea, and internally, the anterior chamber, iris, and lens (Figure 2). Also palpate the preauricular lymph nodes, which collect

lymphatic drainage from the eyelids and conjunctivae. Relevant findings of external examination include^{1,2}:

Skin of lids/face: acne rosacea, seborrhea, psoriasis, other dermatosis

Table 2. PATIENT HISTORY

Symptom history

- Onset and course: acute vs chronic; progressive vs stationary
- Unilateral or bilateral
- Itching, burning, tearing, dryness
- Pain
- Blurred/poor vision
- Discharge: clear, ropy/mucoid, or purulent; eyelids stuck on awakening
- Foreign body sensation
- Sensitivity to light
- Worse at any time of day; improved at any time of day
- Exacerbating/ameliorating factors
 - Any other symptoms, such as fever

Ocular history

- Previous episodes
- Limitations: reading, night driving, viewing TV/computer screen
- Prior exposure to infected individuals
- Trauma; exposure to toxins/chemicals
- Use of topical over-the-counter or prescription medications, cosmetics
- History of ocular surgery or pre-existing condition (ie, glaucoma)
- Contact lens wear
 - Lens intolerance
 - Lens type, hygiene/use regimen (including type of solution)
- History of flaky eyelids, blepharitis
- Exposure to upper respiratory tract infections or viruses

General health history

- Recent upper respiratory tract infections
- Viral or bacterial infections involving genitals
- Sexually transmitted infections or urethral discharge
- Dermatologic conditions
- Current or prior systemic disease (eg, atopy, leukemia, carcinoma, other)
- Autoimmune disorders
- Hypertension
- Bleeding disorders
- Medications (eg, diuretics, anticholinergics, antidepressants, antihistamines, warfarin)

Social history

- Environmental exposure
- Sexual history (as indicated)
- Lifestyle
- Travel

Family history

- Autoimmune diseases
- Diabetes
- Ocular history

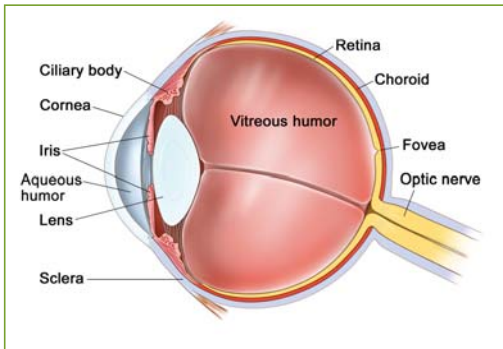


Figure 2. Anatomy of the eye.

Eyelids: edema, ecchymosis, discoloration, ectropion, entropion, trichiasis, misdirected lashes, ulcers, eruptions, erythema, tumors, scaling, lagophthalmos, lid laxity, blepharitis, molluscum lesions, lid retraction

Eyeball: proptosis, enophthalmos, displacement

Conjunctiva (pattern of hyperemia): diffuse, focal, superior, inferior, circumlimbal, intrapalpebral, bulbar, palpebral; characteristics of discharge: purulent, mucopurulent, mucous, serous

Regional: preauricular, submandibular, and cervical-node lymphadenopathy

Relevant findings of examination with penlight, ophthalmoscope, or other source of magnification include^{1,2}:

Bulbar conjunctiva: hyperemia, follicles, cysts, chemosis, hemorrhage, abrasion, ulcers, foreign body, lacerations, growths

Tarsal conjunctiva: papillae, follicles, foreign bodies, abrasions, ulcers, granulomas, concretions, chemosis, scarring

Cornea: abrasions, erosions, scarring,

ulcers, infiltrates, foreign bodies, punctate keratitis, keratoses, dystrophies

Anterior chamber/iris/lens:

cells and flare, rubeosis iridis, cataract, chamber depth, angle anatomy, iris nodules

Specialized testing (eg, cultures, smears, scrapings, fluorescent monoclonal antibody and other serologic tests) is generally not needed. Such tests

may be indicated for patients with chronic, recurrent conjunctivitis or refractory acute disease or in hyperpurulent or fulminant cases. In these instances, the patient should be referred to an ophthalmologist.

Use of Fluorescein Stain

The most useful technique for identifying and evaluating the integrity of the cornea is staining with fluorescein (Figure 3). This technique can be useful to identify foreign bodies, abrasions, and dendritic ulcers caused by herpes infections. The procedure is very simple. The moistened fluorescein strip is touched to the lower conjunctiva, and the patient is asked to blink. The eye is then examined with a cobalt blue light (UV), inspecting for patterns of fluorescence. The size and pattern of the defect is easily identified and will help delineate the nature and extent of the injury. Excess dye should be washed from the eye with sterile saline.

Mark P. Christiansen, PA-C, PhD

DIAGNOSIS

Combined with findings from the patient's clinical presentation, history, and examination, the discharge yields

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important clues about the probable cause of conjunctivitis: a clear discharge and itching indicate allergy; a clear or serous/mucoid discharge without itching suggests a virus; a purulent discharge suggests bacterial or chlamydial infection; and sudden onset of copious purulent discharge indicates hyperacute bacterial conjunctivitis.

Primary Characteristics

Allergy-related. Though relatively benign, this common condition is estimated to affect more than 20% of the population. It causes significant morbidity, suffering, lost productivity, and use of healthcare resources.¹ Allergic conjunctivitis is a hypersensitivity reaction in

which the allergen reacts with immunoglobulin E (IgE) antibodies on the ocular surface, stimulating mast cell degranulation and the release of inflammatory mediators.¹ It is widely believed that the eye is the most common target organ of the IgE/mast hypersensitivity reaction.² This form of conjunctivitis, whether seasonal or perennial, is often associated with such atopic diseases as allergic rhinitis, eczema, and asthma. Symptoms are usually bilateral and typically associated with excessive tearing and blurring of vision, but they do not commonly cause any loss of vision (Table 3). **Bacterial.** Bacterial conjunctivitis is highly contagious and is typically acquired by contact with infected fingers. The

Table 3. CHARACTERISTICS OF ALLERGY-RELATED CONJUNCTIVITIS

Type	Causes	Signs	Symptoms
Atopic	- Atopic dermatitis	- Hyperemia - Chemotic bulbar conjunctiva	- Painless tearing - Intense itching - Redness
Seasonal/perennial	- Ragweed - Pollen - Dust - Mold spores	- Seasonal/recurrent - Mild hyperemia - Chemosis - Mixed papillae/follicles	- Tearing - Mucoid discharge
Vernal	- Dry, warm climates - Usually seasonal in temperate climates (intense in spring and mild in autumn)	<i>Palpebral form:</i> - Giant papillae in upper tarsal conjunctiva <i>Limbal form:</i> - Gelatinous thickening of superior limbal conjunctiva - Distinct nodules in limbal area - Trantas' dots (small white eosinophilic concretions on surface of conjunctiva) are pathognomonic	- Severe itching - Copious, ropy mucoid discharge
Giant papillary	- Contact lenses - Ocular prostheses - Exposed sutures	- Acute/chronic, giant papillae - Preauricular lymphadenopathy is unusual	- Contact lens intolerance - Mucous discharge

American Optometric Association.¹

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infection usually begins in one eye but can become bilateral. Discharge is purulent or mucopurulent, and morning lid crusting is typical (Figure 4). If discharge is copious and yellow-green and accompanied by



Figure 4. Bacterial conjunctivitis with purulent discharge.



Figure 5. Infectious (viral) conjunctivitis.



Figure 6. Partially treated infectious (viral) conjunctivitis.

pain, the patient has hyperacute bacterial conjunctivitis. (Table 4).

Viral. The viruses most commonly associated with conjunctivitis are adenovirus and herpesvirus. Adenoviral infections affect millions worldwide and may be the most common external ocular infection (Figures 5 and 6).¹ The infection is usually acquired through direct contact with contaminated fingers, medical instruments, swimming pool water, or personal items. Ocular symptoms may be associated with a viral prodrome followed by fever, adenopathy, pharyngitis, or upper respiratory tract illness (pharyngeal conjunctival fever), or they may appear on their own.¹ The history reveals personal or social contact with upper respiratory tract viruses or bacteria. Viral conjunctivitis can be spread by coughing. The infection usually begins unilaterally and can become bilateral. Vision is normal (Table 5).

Herpesvirus-related. This type of conjunctivitis is often acute. The herpes simplex virus is a significant ocular pathogen and the primary cause of blindness from corneal disease in the United States. The diagnosis should be considered in all young patients who present with acute conjunctivitis. Herpes zoster is a recurrent varicella-zoster infection. Fifty percent of those with herpes zoster ophthalmicus (involves the ophthalmic division of the trigeminal nerve) show ocular involvement, of which conjunctivitis is the most common manifestation (Table 5).¹

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Chlamydial. *Chlamydia trachomatis* is responsible for the most common sexually transmitted infection in the United States.³ The associated conjunctivitis, which can be acute or chronic, is acquired either through genital-eye contact with an infected partner or by autoinoculation. It is particularly common in young, sexually active adults and persons who live in areas with high rates of sexually transmitted diseases. The condition can lead to adult inclusion conjunctivitis, ophthalmia neonatorum, trachoma, and lymphogranuloma venereum.

Chlamydial conjunctivitis presents with mucopurulent discharge, and patients often describe eyelids that are “glued shut” on awakening. Vision may be blurred, and pupils are abnormally reactive to light. Corneas are normal. Other findings include conjunctival injection and hyperemia as well as large follicles in the lower palpebral and fornix conjunctiva. There may be lid edema and swelling of preauricular lymph nodes (Table 6).

Other types of conjunctivitis include those related to dry eye, blepharitis,

Table 4. CHARACTERISTICS OF BACTERIAL CONJUNCTIVITIS

Type	Causes	Signs	Symptoms
Hyperacute	<ul style="list-style-type: none"> - <i>Neisseria gonorrhoeae</i> - Less often: <i>N meningitidis</i>, <i>Staphylococcus aureus</i>, <i>Streptococcus</i>, <i>Haemophilus</i>, <i>Pseudomonas aeruginosa</i> 	<ul style="list-style-type: none"> - Chemosis - Corneal involvement possible - Diminished vision - Globe tenderness - Preauricular lymphadenopathy (occasional) 	<ul style="list-style-type: none"> - Copious yellow-green purulent discharge - Severe pain
Acute	<ul style="list-style-type: none"> - Adults: <i>S aureus</i> Children^a: <i>S pneumoniae</i>, <i>Haemophilus influenzae</i> - Less common: <i>Staphylococcus</i> sp, <i>Moraxella</i>, <i>Pseudomonas</i> sp, <i>N gonorrhoeae</i>, gram-negative bacteria 	<ul style="list-style-type: none"> - Acute onset - Moderate diffuse hyperemia - Eyelid edema - Conjunctival injection - Normal pupil reaction - No corneal involvement - Papillae - Preauricular lymphadenopathy is unusual 	<ul style="list-style-type: none"> - Tearing - Lid crusting - Unilateral purulent or mucopurulent discharge
Chronic	<ul style="list-style-type: none"> - <i>S aureus</i> 	<ul style="list-style-type: none"> - Prolonged/recurrent symptoms - Low-grade hyperemia - Mixed follicles/papillae - Eyelid edema, conjunctival injection - Normal pupil reaction - No corneal involvement - Preauricular lymphadenopathy is unusual 	<ul style="list-style-type: none"> - Lid crusting - Foreign body sensation

^aIn children aged 6 months to 3 years, bluish discoloration and swelling of the periorbital skin suggests *Haemophilus influenzae* infection. This can progress to involve orbital cellulitis, septicemia, meningitis, septic arthritis, or endophthalmitis. American Optometric Association¹; Cronau H et al.⁴

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contact lenses, mechanical influences, trauma, and chemical burns. Table 7 provides a summary.

Indications for Referral

Certain conditions in a patient of any age require immediate referral to an ophthalmologist. These include reduction of visual acuity, severe ocular pain, severe foreign body sensation, photophobia, unilateral red eye with nausea/vomiting, corneal opacity, fixed pupil, copious purulent discharge, keratitis, hyphema (blood in anterior chamber), hypopyon (pus in anterior chamber), acute glaucoma, trauma, and

presence of ciliary blush suggesting uveitis. Any condition for which topical or systemic steroids are considered (eg, severe acute allergic conjunctivitis) is cause for an ophthalmology referral.

Referral to an allergist or clinical immunologist is indicated for systemic evaluation of atopy (eg, eczema, rhinitis, sinusitis, asthma); consideration of immunotherapy; systemic assessment of a suspected autoimmune process; and persistent, moderate to severe clinical allergic symptoms.

Any patient with persistent qualities or complaints of any ocular symptom should be referred to the appropriate

Table 5. CHARACTERISTICS OF ADENOVIRAL AND HERPES VIRUS-RELATED CONJUNCTIVITIS

Type	Causes	Signs	Symptoms
Adenoviral	- Any of 47 adenovirus serotypes	- Acute onset - Bulbar and palpebral hyperemia - Normal pupil size/reaction to light - Petechial hemorrhages, especially in bulbar conjunctiva - Diffuse punctate keratitis can cause multiple corneal subepithelial infiltrates - Possible lid edema - Preauricular lymphadenopathy often more pronounced where infection began	- Tearing - Crusty lids on awakening - Mild to no pain - Occasional gritty discomfort
Herpetic	- Herpes simplex (<i>Herpesvirus hominis</i>) - Varicella-zoster (<i>Herpesvirus varicellae</i>) - Epstein-Barr	- Acute, lid edema - Normal pupil size and reaction to light - Diffuse conjunctival injections - Occasional preauricular lymphadenopathy - Vesicular rash can exist on lids or periorbital skin - Uveitis - Keratitis - Ulceration possible on conjunctival surface	- Tearing, pain, tingling precedes rash and conjunctivitis - Unilateral with dermatomal involvement - Herpes zoster ophthalmicus may present prodrome: headache, malaise, fever, unilateral pain; vesicular eruption along trigeminal dermatome

American Optometric Association.¹

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specialist. Referral should be made at the patient's request, in accordance with the physician's treatment plan.

MANAGEMENT

The goals of intervention are to resolve and contain underlying infection, help the patient feel more comfortable, ensure eye health, and preserve vision. Some patients with conjunctivitis require immediate referral to an ophthalmologist, but most can be managed with appropriate medications and good hygiene.

Allergic Conjunctivitis

Allergic conjunctivitis can be managed with a combination of palliative measures—allergen avoidance, consistent use of preservative-free lubricants, and cold compresses—and topical medications. The choice of medication is empiric. There are 2 caveats with these preparations: patients need to avoid touching the tip of the dropper or tube to any surface other than the eye, and patients who wear contact lenses must remove them before applying the drops

and wait at least 10 minutes before reinserting the lenses.

Medication Categories

Histamine H₁ receptor antagonists.

These bind competitively with histamine receptor sites, reducing vasodilation and instantly relieving itching. However, they do nothing to alleviate redness. They are a good choice for patients with mild allergies. Topical antihistamines also are preferable to systemic antihistamines because they act faster and are less drying.

Emedastine 0.05%, 1 drop 4 times a day, quickly alleviates itching, eyelid swelling, and other signs and symptoms of seasonal allergic conjunctivitis.

However, the effects last only a few hours, requiring frequent treatment. Side effects include mild stinging and burning of the eyes, headaches, and sleepiness.

Mast cell stabilizers. These medications inhibit mast cell degranulation, thereby preventing the release of inflammatory mediators. They are effective for all types of eye allergies and are recommended for patients with mild to moderately severe

Table 6. CHARACTERISTICS OF CHLAMYDIAL CONJUNCTIVITIS

Type	Causes	Signs	Symptoms
Chlamydial	- <i>Chlamydia trachomatis</i>	- Acute/chronic - Pupils reactive to light - No corneal involvement - Conjunctival injections and hyperemia - Large follicles in lower palpebral and fornix conjunctiva - Preauricular lymph nodes can be swollen - Possible lid edema	- Mucopurulent or purulent discharge - Eyes "glued" on awakening - Vision blurred

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allergies. To prevent itching, mast cell stabilizers must be taken before exposure to the allergen. Agents in this class include cromolyn sodium, lodoxamide, nedocromil, and pemirolast (Table 8).

Mast cell stabilizers + H_1 receptor antagonists. This new generation of combination agents works by inhibiting mast cells and preventing histamine release. They are used for patients who have

Table 7. CHARACTERISTICS OF OTHER TYPES OF CONJUNCTIVITIS

Type	Causes	Signs	Symptoms
Blepharitis	<ul style="list-style-type: none"> - Chronic staphylococcal infection of the eyelids 	<ul style="list-style-type: none"> - Scaling of eyelashes - Missing eyelashes - Swollen eyelids - Secondary changes in conjunctiva and cornea 	<ul style="list-style-type: none"> - Itchy, crusted eyelids - Redness, irritation worse on awakening
Contact lens	<ul style="list-style-type: none"> - Allergy - Tissue hypoxia - Giant papillary conjunctivitis 	<ul style="list-style-type: none"> - Hyperemia - Abnormal conjunctival thickening 	<ul style="list-style-type: none"> - Mild itching - Mucous discharge
Dry eye (keratoconjunctivitis sicca) due to tear film dysfunction	<ul style="list-style-type: none"> - Decreased tear production, distribution, or absorption - Poor tear quality - Medications (anticholinergics, antihistamines, oral contraceptives) - Sjögren's syndrome 	<ul style="list-style-type: none"> - Vision usually preserved - Pupils reactive to light - Hyperemia - No corneal involvement 	<ul style="list-style-type: none"> - Bilateral itching - Foreign body or grittiness sensation - Mild pain - Intermittent watering
Mechanical	<ul style="list-style-type: none"> - Entropion - Eyelashes - Trichiasis - Foreign bodies - Sutures 	<ul style="list-style-type: none"> - Conjunctival hyperemia (focal or diffuse) 	<ul style="list-style-type: none"> - Tearing - Foreign body sensation
Traumatic	<ul style="list-style-type: none"> - Direct (corneal abrasions, lacerations, epithelial defects) - Indirect (chemical) injury 	<ul style="list-style-type: none"> - Conjunctival hyperemia 	<ul style="list-style-type: none"> - Tearing - Foreign body sensation
Subconjunctival hemorrhage	<ul style="list-style-type: none"> - Trauma - Hypertension - Straining - Severe coughing - Atherosclerosis - Bleeding disorders - Medication (warfarin) 	<ul style="list-style-type: none"> - Normal vision - Pupils equal and react to light - Bright red patch on sclera - No corneal involvement 	<ul style="list-style-type: none"> - Pain absent or mild - No discharge
Chemical burn	<ul style="list-style-type: none"> - Oven cleaner - Drain cleaner - Cement - Plaster powder, etc 	<ul style="list-style-type: none"> - Diminished vision - Corneal involvement is common 	<ul style="list-style-type: none"> - Severe pain - Red eye - Photophobia

American Optometric Association¹; Cronau H et al.⁴

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both itching and redness. Olopatadine 0.2% can also help prevent ocular allergy attacks. The characteristics of medications in this class are summarized in Table 9.

Nonsteroidal anti-inflammatory drugs (NSAIDs). These inhibit the cyclooxygenase pathway to alleviate inflammation and are especially useful for treating itchy eyes. Ketorolac, 1 drop 4 times a day, is the ophthalmic preparation that is used for patients with allergic conjunctivitis. It works quickly but can cause temporary burning and stinging of the eyes in about 40% of patients treated.

Vasoconstrictors + antihistamines. These combination agents shrink the blood vessels in the conjunctiva to reduce redness and block the effect of histamines,

which controls itching. Older preparations may cause drowsiness, and newer ones can cause dry eye. Naphazoline/pheniramine, 1 to 2 drops 4 times a day, is a vasoconstrictor/antihistamine that is prescribed for short-term relief of mild allergic conjunctivitis.

Corticosteroids. Clinicians in primary care should not initiate corticosteroid eyedrops unless working with a consulting eye specialist. These medications are reserved for patients with severe allergic conjunctivitis, and their use needs to be precisely monitored. Chronic use can increase intraocular pressure and cause cataracts. A patient who presents to primary care already receiving ocular steroids should also be referred. Ophthalmic

Table 8. ALLERGIC CONJUNCTIVITIS: MAST CELL STABILIZERS

Agent/Strength	Approved Dosage	Advantages	Disadvantages
Cromolyn sodium 4%; 10 mL - OTC	≥4 y; 1 or 2 drops, every 4-6 h	- Effective for mild vernal keratoconjunctivitis, mild allergic rhinoconjunctivitis	- Slow onset of action - May cause transient stinging/burning
- Lodoxamide 0.1% 10 mL	≥2 y; 1 or 2 drops, 4× daily	- Faster-acting and 2500× more potent than cromolyn - Can be used in children <2 y - Minimal side effects	- Frequent dosing - Long-term administration necessary to prevent symptoms
Nedocromil 2% 5 mL	≥3 y; 1 or 2 drops, 2× daily	- Relieves itching, watering, burning - Convenient 2× daily dosing - No serious side effects	- Avoid if there is bacterial, fungal, or viral infection of the eye
Pemirolast 0.1% 10 mL	≥3 y; 1 or 2 drops 4× daily	- Can relieve itching within a few days	- Can cause headache, dry eyes, runny nose Can take up to 4 weeks to take effect

OTC = over-the-counter. Data from prescribing information for each agent; American Optometric Association¹; Cronau H et al.⁴

corticosteroid preparations include:

- Dexamethasone 0.1% suspension and solution
- Fluorometholone acetate 0.1% suspension
- Loteprednol etabonate 0.2% to 0.5% suspension (approved for treatment of allergic conjunctivitis)
- Medrysone 1.0% suspension
- Prednisolone acetate 0.12% to 1.0% suspension
- Prednisolone sodium phosphate 0.125% to 1.0% solution
- Rimexolone 1.0% suspension

Loteprednol etabonate is a site-specific steroid, developed to reduce the long-standing complications associated with topical steroids. Both the 0.2% and 0.5% concentrations demonstrate a low propensity to elevate intraocular pressure. The 0.5% concentration is effective prophylaxis for seasonal allergic conjunctivitis and the 0.2% concentration is effective treatment for the seasonal disorder. Topical cyclosporine A 2.0%, FDA-approved for treatment of chronic dry eye, is an alternative for patients with severe atopic keratoconjunctivitis or severe recalcitrant vernal keratoconjunctivitis.¹

Caution With Ocular Topical Corticosteroids

The use of topical corticosteroid medications, including antibiotic-steroid combinations, such as tobramycin-dexamethasone, may increase intraocular pressure, cause cataracts, or potentiate fungal and viral infections. The development of steroid

glaucoma, a form of open-angle glaucoma, has also been documented. Complications may include permanent vision loss. There is no safe steroid dose. Generally, any ocular condition that warrants the use of topical steroids also warrants consultation with an ophthalmologist. A telephone conference may be appropriate in some instances, but in most cases, the ophthalmologist should examine the patient and determine the choice of topical steroid based on the clinical evaluation.

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Bacterial Conjunctivitis

Ideally—as is the case with hyperacute bacterial conjunctivitis—the cause of infection is identified by culture and the patient is treated with an antibiotic specific for that pathogen. Usually, however, the choice of treatment is guided by the most likely pathogen, which can vary with the patient's age:

- In adults, choose an antibiotic with activity against *Staphylococcus* species, including *S aureus* and *S epidermidis*; *Streptococcus* species; and gram-negative organisms, primarily *Escherichia coli*, *Pseudomonas* species, and *Moraxella* species.⁵
- In children, choose an antibiotic that is effective against *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus* species, and *Moraxella* species.⁵

Although bacterial conjunctivitis tends to be self-limited, a broad-spectrum antibiotic can increase comfort and hasten recovery. It also helps contain the

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spread of infection. Bacterial conjunctivitis is contagious until the eyes are clear and there is no discharge. This may be after several days without treatment or about 24 hours after starting effective treatment. Topical antibiotics are generally preferable to systemic medications, as they provide targeted treatment and have fewer side effects. They also contribute less to the development of bacterial resistance. The choice of agent is empiric, depending on clinician experience and preference as well as such patient considerations as comfort, tolerance, and adherence. For all agents, a full course of treatment is 7 days—even if symptoms subside before that.

Several classes of antibiotics are avail-

able for managing conjunctivitis:

Aminoglycosides. These antibiotics are indicated for treating gram-negative infections and have limited efficacy against gram-positive organisms (Table 10).

Macrolides. Erythromycin is effective against gram-positive bacteria, as well as *Mycoplasma* species, *Legionella* species, and *Chlamydia* species. For patients who do not want an ointment, azithromycin ophthalmic solution is an alternative that is effective against most causes of bacterial conjunctivitis (Table 10).

Fluoroquinolones. Fourth-generation agents are the fluoroquinolones of choice in part because they do not yet face the same degree of resistance now seen with earlier generations (Table 11), although

Table 9. ALLERGIC CONJUNCTIVITIS: MAST CELL STABILIZERS + ANTIHISTAMINES

Agent/Strength	Approved Dosage	Advantages	Disadvantages
Azelastine 0.05%; 6 mL	≥3 y: 1 drop 2× daily	- Controls itching	- May interact with cimetidine
Epinastine 0.05%; 5 mL	≥3 y: 1 drop 2× daily	- Controls itching	- Can cause cough, fever, runny nose, sore throat, burning eyes
Ketotifen 0.025%; 5 mL (OTC)	≥3 y: 1 drop every 8-12 h	- Dramatically reduces itching, redness - Rapid onset	- Max 2 doses/d May be more irritating than olopatadine
Olopatadine 0.2%; 2.5 mL	≥3 y: 1 drop 1× daily (first agent approved for 1× daily dosing)	- Most effective mast cell stabilizer - Reduces chemosis, tearing, lid swelling - Decreases chemotaxis; inhibits eosinophil activation	- Use caution during pregnancy - Side effects: headache, stinging, blurred vision, nausea
Olopatadine 0.1%; 5 mL	≥3 y: 1 drop 2× daily (6-8 h apart)	- Quickly relieves itching - Use before pollen season or allergen exposure reduces conjunctivitis	

Data from prescribing information for each agent; American Optometric Association¹; Cronau H et al.⁴

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there are signs that resistance is increasing to this newer generation as well.⁶ These agents quickly kill gram-negative and gram-positive organisms as well as anaerobes and are well-tolerated. Some

clinicians recommend using these first to quickly resolve infection.

Antibiotic combinations. Combinations such as polymyxin B with neomycin or trimethoprim work against both gram-

Table 10. BACTERIAL CONJUNCTIVITIS: TOPICAL ANTIBIOTICS

Agent/Strength	Approved Dosage	Advantages	Disadvantages
Aminoglycosides			
Gentamicin sulfate 0.3% solution 5 mL, 15 mL ointment 3.5 g	≥1 mo: Solution: 1-2 drops every 4 h; severe, up to 2 drops hourly Ointment: 1.25 cm 2-3× daily	- Effective against gram-negative organisms - Inexpensive	- Limited coverage against gram-positive organisms - Relatively slow acting - Resistance - Gentamicin can irritate - Resistance of <i>H</i> and <i>S pneumoniae</i> limit use in children
Tobramycin 0.3% solution 5 mL ointment 3.5 g	≥2 mo: Solution: 1-2 drops every 2 h; severe, 2 drops hourly until improvement Ointment: 1.25- cm strip 2-3× daily; severe, 1.25-cm strip every 3-4 h		
Bacitracin 500 U/g (ointment)	0.5- to 1.5-cm strip inside pouch 1-3× daily	- Effective against gram-negative organisms	- Limited coverage against gram-positive organisms, including <i>Staphylococcus</i> and <i>Streptococcus</i>
Chloramphenicol solution 0.5% ointment 1.0%	≥2 y: Solution: Days 1-2: 1 drop every 2 h; Days 3-5: 1 drop every 4 h Ointment: Days 1-5: 1-cm strip inside eyelid, 3-4× daily	- Relatively inexpensive	- Slow onset - Potential for aplastic anemia (rare but unpredictable)
Macrolides			
Azithromycin solution	≥1 y: Days 1-2: 1 drop 2× daily; Days 3-7: 1 drop 1× daily	- Effective against most common causes of bacterial conjunctivitis - Alternative to ointment	- Can cause discomfort (stinging, itching, swelling) in a very small percentage of patients
Erythromycin ophthalmic ointment 0.5% 1 g, 3.5 g	1-cm strip up to 6× daily, depending on infection severity	- Good activity against gram- positive organisms	- Ointment only available - Limited coverage of gram-negative infection - Poor penetration of ocular tissue - Resistance

Data from prescribing information for each agent; American Optometric Association¹; Cronau H et al.⁴

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negative and gram-positive organisms. The combination of polymyxin B and trimethoprim, however, has been linked with resistance (Table 12).⁷

Antibiotics + corticosteroids. Combination agents, such as tobramycin and dexamethasone or tetracycline and hydro-

cortisone, should be prescribed only by an ophthalmologist or after consultation with an ophthalmologist. They are indicated for patients needing very rapid control of infection and inflammation, particularly patients with inflammation of the conjunctiva, cornea, and anterior

Table 11. BACTERIAL CONJUNCTIVITIS: FLUOROQUINOLONE ANTIBIOTICS

Agent/Strength	Approved Dosage	Advantages	Disadvantages
Fluoroquinolones (early generations)			
Ciprofloxacin 0.3% ointment; 3.5 g	≥2 y: Days 1-2: half inch 3× daily; Days 3-7: 2× daily	<ul style="list-style-type: none"> - Well tolerated - Little toxicity - Broad-based efficacy 	<ul style="list-style-type: none"> - Work slowly - Resistance is increasing
Ciprofloxacin 0.3% solution; 2.5 mL, 5 mL, 10 mL	≥1 y: Days 1-2: 1-2 drops every 2 h while awake; Days 3-7: 1-2 drops every 4 h		
Levofloxacin 0.5%; 5 mL	≥1 y: Days 1-2: 1-2 drops every 2 h; Days 3-7: 1-2 drops every 4 h		
Ofloxacin 0.3%; 5 mL	≥1 y: Days 1-2: 1-2 drops every 2-4 h; Days 3-7: 1-2 drops 4× daily		
Fluoroquinolones (fourth generation)			
Moxifloxacin 0.5%; 3 mL	≥1 y: 1 drop 3× daily for 7 d	<ul style="list-style-type: none"> - Rapid activity against gram-negative and gram-positive organisms - Well tolerated - Less resistance 	
Gatifloxacin 0.3%; 5 mL	≥1 y: Days 1-2: 1 drop every 2 h Days 3-7: 1 drop 4× daily		
Besifloxacin 0.6%; 5 mL	≥1 y: 1 drop 4× daily for 7 d	<ul style="list-style-type: none"> - First in class developed specifically for ophthalmic use; no previous systemic formulation - Resistance risk low - Effective against most common causes of bacterial conjunctivitis 	

Data from prescribing information for each agent; American Optometric Association¹; Cronau H et al.⁴

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Table 12. BACTERIAL CONJUNCTIVITIS: COMBINATION ANTIBIOTICS AND SULFONAMIDES

Agent/Strength	Approved Dosage	Advantages	Disadvantages
Antibiotic Combinations			
Polymyxin B 10,000 U/mL + neomycin 1.75 mg/mL + gramicidin 0.025 mg/mL 10 mL	≥18 y: 1-2 drops every 4 h for 7-10 d to 2 drops every 3-4 h	- Effective against gram-negative and gram-positive bacteria - Minimal toxicity - Inexpensive	- Resistance a problem with polymyxin/trimethoprim
Polymyxin B 1000 U/mL + trimethoprim sulfate 1 mg/mL 5 mL	≥2 mo: 1 drop every 3 h, 7-10 d; max 6 doses/d		
Polymyxin B sulfate 10,000 U/g + bacitracin zinc 500 U/g (ointment)	<i>Adults/children:</i> apply every 3-4 h for 7-10 d		
Polymyxin B sulfate 10,000 U/g + bacitracin zinc 400 U/g + neomycin 3.5 mg/g (ointment)	<i>Adults/children:</i> apply every 4 h for 7-10 d		
Antibiotics + Corticosteroids			
Tobramycin 0.3% + dexamethasone 0.1%	≥2 y: Days 1-2: 1 to 2 drops every 2 h; then every 4-6 h	- Rapid inflammation relief and infection control	- Ophthalmologist-prescribed only; not routine agent - Long-term use can cause glaucoma and cataracts - Not recommended for viral or chlamydial conjunctivitis
Sulfonamides			
Sodium sulfacetamide 10% solution 5 mL, 10 mL; 10% ointment	≥2 mo: solution 1 to 2 drops every 2-3 h during the day, less at night Ointment: 1.25- to 2.5-cm strip 4× daily and at bedtime	- Inexpensive	- Bacteriostatic, not bacteriocidal - Contributes to resistance
Sulfisoxazole diolamine 4% ointment; 4% solution	Ointment: 1.25- to 2.5-cm strip 1-3× daily and at bedtime ≥2 mo: solution: 1 drop ≥3× daily		

Data from prescribing information for each agent; American Optometric Association.¹

portion of the globe, or patients with corneal damage related to chemicals, toxins, or trauma.

Because corticosteroids can cause serious adverse effects they are not routinely recommended for treating bacterial conjunctivitis. They also are not recommended for persons with viral or chlamydial conjunctivitis.

Experience With Conjunctivitis

Although bacterial conjunctivitis is usually self-limited, treatment with broad-spectrum antibiotics is often recommended to reduce the risk of transmission as well as complications of prolonged infection. Empiric treatment is highly effective and adverse consequences infrequent. Gram stain may help guide treatment, as some topical antibiotics are more effective for gram-positive and others for gram-negative organisms. The balance is delicate between prescribing an antibiotic and waiting in order to avoid exacerbating the epidemic of drug resistance. Among the benefits of treatment, children are able to return to school and adults to the workplace more quickly.

The neomycin component of some treatments may produce hypersensitivity reactions, and in our practice, we generally avoid them. Administration in children is complicated by the stinging sensation some drops cause. For example, sulfacetamide may sting and also has a high level of resistance.

Infectious conjunctivitis is easily spread through direct contact. Anyone with infectious pink eye or parents of children with the condition should avoid touching the eye area or touching medication dispenser bottles or tubes directly to the eye. Frequent hand washing is essential,

particularly after applying medications to the eye area. Towels, washcloths, or handkerchiefs should not be shared, and tissues should be disposed of after each use. Disinfecting surfaces like countertops, sinks, and doorknobs can also help prevent the indirect spread of infectious pink eye. Children should not return to school as long as there are eye secretions and generally are considered contagious for at least 24 to 48 hours after antibiotic treatment is started. Viral infections remain contagious for at least 7 days after onset.

Mark P. Christiansen, PA-C, PhD

Chlamydial Conjunctivitis

Since chlamydial conjunctivitis originates in the genital tract, patients need treatment with systemic agents. Either one of these regimens is recommended:

- Azithromycin 1 g given as a single dose, OR
- Doxycycline 100 mg 2 times a day for 7 days

Patients and their partners also need an evaluation for sexually transmitted infections.

Viral Conjunctivitis

Viral conjunctivitis is managed with supportive care: cold compresses, lubricants, ocular decongestants, and other measures. **Adenoviral.** Patients should avoid direct contact with others for at least 7 days. Medications are seldom appropriate. Antiviral preparations and topical NSAIDs are ineffective.¹ Topical antibiotics, which can be harsh, are indicated only for patients with evidence of secondary

bacterial infection. Topical corticosteroids can prolong infection, are associated with complications such as glaucoma and cataracts, and should be prescribed only by ophthalmologists treating patients who are severely symptomatic or who have vision loss from inflammatory keratitis.^{1,5}

Herpetic. Ocular herpes simplex and herpes zoster infections sometimes respond to topical and/or systemic medications. Some clinicians prescribe trifluridine, although there is no evidence that this reduces the incidence of recurrent disease or keratitis.¹ Topical corticosteroids are specifically contraindicated for treating herpes simplex. This is not true for patients with herpes zoster, who have less risk for secondary bacterial infection when treated with topical antibiotic/corticosteroid combinations. Systemic antiviral treatment reduces the duration of viral shedding and postherpetic neuralgia. For optimal benefit, the systemic antiviral should be initiated within 72 hours of first symptoms.¹

Other Types of Conjunctivitis

Other forms of conjunctivitis are primarily managed with a combined approach of supportive care and correction of the underlying cause of symptoms.

Blepharitis. Eyelid hygiene, gentle lid massage, and warm compresses are the cornerstones of care. For additional relief, topical erythromycin or bacitracin ophthalmic ointment can be applied to

eyelids. Systemic antibiotics (doxycycline or tetracycline) or topical corticosteroids may alleviate severe cases.

Contact lenses. Discontinue wearing lenses. Correct solution allergies, hypoxia, bacterial infection, and trauma.

Dry eye (tear film dysfunction).

Frequently apply artificial tears during the day and lubricant ointment at night. Humidifiers and eyeglasses with side shields preserve moisture. Cyclosporine A 0.05% ophthalmic emulsion may stimulate tear production. Systemic omega-3 fatty acids can help keep the eye moist. Topical corticosteroids reduce inflammation.

Mechanical insult. Remove the causative agent and lubricate the eye. Use fluorescein stain to help identify abrasions and other damage. Consider broad-spectrum antibiotic drops if the epithelium is damaged.

Traumatic. Treatment varies with the nature of injury:

- Conjunctival abrasions: topical antibiotics, cycloplegia
- Epithelial disruption (corneal, conjunctival): topical antibiotics, oral analgesics
- Chemical injury: extensive irrigation with normal saline/balanced salt until pH of conjunctival sac is normal

Toxic. Identify and remove the offending agent. Remove molluscum lesions if present. Discontinue suspect topical medications, and switch to preservative-free lubricants, 4 to 8 times a day, for 3 to 5 days. Supportive care with cold

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compresses and/or topical antibiotic/corticosteroid ophthalmic preparations can help.

Follow-up Care and Prevention

Patients need to understand the importance of taking the full course of their prescribed medications. Good hygiene is essential as well. People with infectious types of conjunctivitis should be reminded to wash their hands frequently, keep washcloths, towels, and other linens separate from anyone sharing living quarters, and try to minimize or eliminate contact with others for 1 to 2 weeks after the infection begins.

The frequency of follow-up visits varies with the type and severity of conjunctivitis and potential for ocular morbidity. In addition to verifying response to treatment and checking for complications, these visits are an opportune time to reinforce personal hygiene and other patient education issues.

When to Watch, When to Refer

Most mild cases of conjunctivitis resolve without issue, and no follow-up is generally required. If there is no significant improvement after 24 hours of antibiotic use, if the condition worsens, or if vision disturbance or other symptoms develop, the patient should be seen again and reevaluated for possible signs that would indicate a need for referral to an ophthalmologist.

Any patient who is found to have a corneal defect, no matter how small, requires daily follow-up until the cornea has completely healed and there is no staining with fluorescein. The patient should

also be informed that if there is an increase in light sensitivity, eye pain, or blurring of vision, they need to return immediately. The cornea generally heals very quickly. Even larger abrasions often can heal completely in 24 hours. If healing is slow, this may indicate deeper infection, retained foreign body, or other concerns that need further evaluation by an ophthalmologist. Do not delay reevaluation or referral. The loss of vision or other complications from improperly treated infection or injury can be devastating. Always err on the side of caution.

Mark P. Christiansen, PA-C, PhD

All photographs in *Part I: Conjunctivitis* courtesy of Leonard Bielory, MD.

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Part II: OTITIS

ACUTE OTITIS MEDIA

Overview

Acute otitis media (AOM) is the most common reason for a child to receive an antibiotic and the most common reason for a child to undergo anesthesia—for placement of tympanostomy tubes. During the 1990s alone, AOM accounted for 25 million office visits to primary care clinicians. Those clinicians prescribed 809 antibiotics per 1000 visits, for a total of 20 million prescriptions for otitis-related antibiotics.¹ Costs of these prescriptions ranged from \$10 to \$100 each.

Concerns about controlling the dual problem of cost and antibiotic resist-

ance are shifting the paradigm of care toward more judicious use of antibiotics. The American Academy of Pediatrics and the American Academy of Family Physicians have issued evidence-based guidelines for managing uncomplicated AOM in otherwise healthy children. The following material draws on recommendations from both organizations. The primary clinical focus is to accurately diagnose AOM and reserve antibiotic treatment for those patients who meet diagnostic criteria, while controlling pain in every patient with otalgia. Observational study data indicate low risks of AOM progressing to mastoiditis, meningitis, or other intracranial complications.

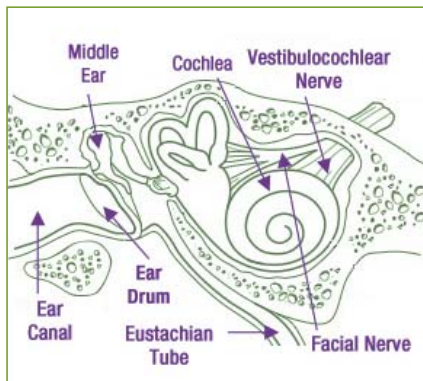


Figure 1. Structures of the middle ear.

Characteristics of AOM

AOM is a viral or bacterial infection that affects the structures of the middle ear (Figure 1). The infection begins suddenly and is accompanied by middle ear effusion (MEE) as well as the signs and symptoms of middle ear inflammation (Figure 2). Three elements are required for diagnosis of AOM:

Recent, usually abrupt onset of signs and symptoms of MEE. Infants

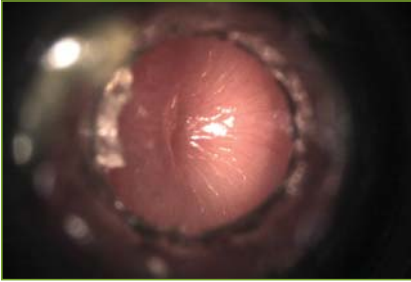


Figure 2. Acute otitis media.

and young children will have pain, irritability, poor feeding, fever, crying, nasal congestion or discharge, cough, nausea, vomiting, diarrhea, and other nonspecific symptoms. Infants might tug at the ear. AOM might present as sudden purulent otorrhea with rupture of the tympanic membrane or in the presence of tympanostomy tubes. Adults characteristically complain of ear pain and drainage, hearing loss, and sore throat or upper respiratory tract infection.

Presence of MEE. Bulging or limited/absent mobility of the tympanic membrane, air-fluid level behind the tympanic membrane, or otorrhea.

Middle ear inflammation. Frank erythema of the tympanic membrane or distinct otalgia (clearly related to the ear) that precludes normal activity or sleep.

AOM can be recurrent and persistent. If evidence of middle ear infection continues during antibiotic treatment or if AOM recurs within a month of treatment, the patient is considered to have persistent AOM. Recurrent AOM is defined as 3 or more

episodes of AOM that occur within 6 to 18 months.

Natural History

AOM is most prevalent in children aged 6 months to 3 years. Adults are affected far less often.² Most properly monitored children recover without antibiotics: symptoms typically diminish within 1 day and vanish within 7 to 14 days.¹

Complications affect fewer than 1 in 100,000 children annually and include:

- Persistent conductive hearing loss or sensorineural hearing loss
- Acute mastoiditis leading to subcutaneous pus (Bezold abscess)
- Chronic mastoiditis
- Labyrinthitis
- Rarely, spread of infection beyond the temporal bone to meninges or brain (epidural or subdural abscess or brain abscess)

Risk factors for AOM are numerous and include lack of breastfeeding, premature birth, family history, early development of AOM, exposure to smoke and other pollutants, and day care attendance.² The most common presentation is congestion and swelling of the nasal mucosa, nasopharynx, and eustachian tube caused by an allergy or upper respiratory tract infection. In infants and young children, the eustachian tube is short and relatively horizontal. While this situation changes with normal growth, it is a relatively dysfunctional orientation. When the immature eustachian tube becomes

obstructed or constricted, secretions accumulate and negative pressure develops, creating a reservoir for bacterial or viral infection. This leads to suppuration and inflammation. Persistent inflammation sets the stage for otitis media with effusion (OME).

The causative pathogen can vary depending on the presence or absence of tympanostomy tubes and the patient's age:

Children. *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*. *Mycoplasma pneumoniae*, *Chlamydia* sp, *Mycobacterium tuberculosis*, parasites, and mycoses are also rare causes. Tympanostomy tubes: gram-negative bacteria.

Adults. *S pneumoniae*, group A β -hemolytic streptococci, *Staphylococcus aureus*, *H influenzae*

The viruses that can cause AOM include respiratory syncytial virus, rhinovirus, coronavirus, parainfluenza virus, adenovirus, and enterovirus. These may be responsible for AOM that does not respond to antibiotics.

Clinical Evaluation

Patient Presentation

Infants and children. Nonspecific signs and symptoms resemble those of respiratory tract infection or systemic illness. Otalgia that begins suddenly or is serious enough to disrupt normal activity or sleep, ear pulling or rubbing, and/or parental suspicion of otitis are clues to AOM. Onset is acute and includes fever. Children with a perforated tympanic membrane (Figure 3) may have abrupt resolution of pain with otorrhea; those with tympanostomy tubes can have suppurative otitis media and present with persistent or recurrent otorrhea (Figure 4).

Adults. In adults, otalgia, ear drainage, diminished hearing, and sore throat are clues to AOM.

History and Examination

Explore the history for predisposing circumstances (ie, exposure to upper respiratory tract virus) and risk factors. Generally, the ear examination is more



Figure 3. Posterior tympanic membrane perforation.



Figure 4. Tympanostomy tube with otorrhea.

diagnostic than the history. Begin the examination with the basics:

- Constitution
- Mental status
- Gross neurologic examination and cranial nerve examination: abnormal extraocular movements and/or facial nerve paresis/paralysis indicate extension of the infection beyond the temporal bone or middle ear
- Inspection: nose and oropharynx, teeth, auricle, and periauricular region
- Palpation: head and neck
- Red flags: severe headache, mental status changes, confusion, the report of severe hearing loss, imbalance, or vertigo may indicate extension of the infection into the inner ear or brain and require immediate referral

Next, examine the patient’s ears. Before starting, ensure that the room has adequate lighting and have an assistant available to hold a child who struggles. Cerumen should be removed to ensure adequate visualization. Otoscopy is essential for identifying MEE in children with AOM. Be sure the otoscope’s light source is on full power for adequate visualization. If the bulb is dim, the tympanic membrane can appear dull and reddish.

Choose the largest otoscope tip that fits the canal, for secure seal and optimal visualization. Position a child on his or her back, head turned to the side, or sitting in the parent’s lap. Hold the otoscope near the eyepiece to minimize movement in the canal. In older children

Table 1. EAR EXAMINATION FOR AOM

Test	Findings
Otoscopy	<p><i>Intact tympanic membrane:</i></p> <ul style="list-style-type: none"> - Fullness/bulging - Inflammation, opacification, edema - Bubbles behind tympanic membrane <p><i>Perforated tympanic membrane or tubes:</i></p> <ul style="list-style-type: none"> - Purulent otorrhea, bloody discharge - Chronic suppurative otitis media may show persistent or recurrent otorrhea, thickened granular mucosa, polyps, cholesteatoma in middle ear
Pneumatic otoscopy	- Tympanic membrane mobility reduced or absent
Audiometry	<ul style="list-style-type: none"> - AOM may cause modest (20-50 dB) hearing loss, usually ‘conductive’ pattern (sound not transmitted to inner ear) - Audiometry reveals “air-bone” gap, (sound heard better when transmission bypasses middle ear bones)
Tympanometry	<ul style="list-style-type: none"> - Stiff tympanic membrane: flat (type B) tracing - Retracted tympanic membrane: highly negative middle ear pressures (type C tracking) - Bulging tympanic membrane: tracing with abnormally positive peak pressure

Ramakrishnan K et al²; AAHP/AAOHNS/AAP³; Hain TC.⁴

and adults, pull the auricle upward and backward. In young children and infants, pull the auricle downward and backward, aligning the acoustic meatus with the canal. Typically convex, translucent, and grayish, in AOM the tympanic membrane is bulging, bright red, and may have air bubbles behind it. Use pneumatic otoscopy (positive and negative pressure) to check membrane mobility. Stiffness or reduced mobility is consistent with MEE.

Table 1 lists the components of the comprehensive ear examination and the relevant findings that support the diagnosis of AOM.

Optimal Otoscopy

Holding the otoscope head like a pencil, so that your hand is actually between the child's head and the instrument, provides some protection for the patient in case of sudden movement, which is common with children or agitated patients.

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Referral for Specialized Testing

Sophisticated tests, imaging studies, and nasopharyngeal cultures are not routinely recommended as part of the AOM workup unless symptoms persist, in which case the patient would be referred to a specialist. Tests considered might include computed tomography to rule out bony extension and intracranial complications. Tympanocentesis, followed by aspiration and culture of the middle ear fluid samples, is helpful in children who are exceptionally ill (toxic),

immunodeficient, or unresponsive to antibiotics.

Management

The main goals of management are to alleviate the child's symptoms and to prevent recurrence. The choice of initial treatment depends on the child's age and the certainty of the AOM diagnosis¹:

Infants younger than 6 months.

Immediate antibiotics, whether the diagnosis is certain or not.

Children 6 to 24 months. Antibiotics, unless the diagnosis of AOM is uncertain and symptoms are not severe.

Persons 2 years and older.

Observation, unless the diagnosis is certain and AOM is severe.

Because most cases of AOM resolve spontaneously, 48 to 72 hours of vigilant watchful waiting, along with pain control, are appropriate for children with uncomplicated AOM.

Pain Control

Pain management is a key aspect of care in the first few days of AOM yet can be overlooked in the effort to treat underlying cause. The choice of pain control strategy (Table 2) depends on pain severity, as well as personal preferences of the patient/caregiver and clinician.

Antibiotic Treatment

Children Without Tympanostomy Tubes

Several classes of broad-spectrum medications are available to manage AOM: ampicillin analogs, macrolides, and

cephalosporins. The choice of drug depends on whether the child is able to take penicillin (Table 3); has a history of penicillin allergy without urticaria or anaphylaxis (Table 4); or, has a penicillin allergy that triggers urticaria or anaphylaxis (Table 5). Other factors that determine the choice of medication include the anticipated clinical response, as well as the likely causative bacteria. The clinician's prescribing practices or preferences, the cost of the medication, and the patient's acceptance/tolerance of the medication and ability to comply with the dosing schedule are other considerations. Keep

in mind that antibiotic treatment can mask signs and symptoms of mastoiditis.

The optimal duration of treatment is not well-defined.¹ However, based on available data, 10 days of treatment are recommended for young (less than 6 years) children and those with serious infection. Persons 6 years of age and older who have mild to moderate AOM can be treated for 5 to 7 days.

Children With Tympanostomy Tubes

These patients respond better to topical antibiotics than to systemic antibiotics,⁵ possibly because topicals deliver a

Table 2. MANAGING OTALGIA IN AOM

Agent	Approved Dosage	Advantages	Disadvantages
Oral Analgesics			
Acetaminophen: tablet, chewable tablet, capsule, effervescent granule elixir, powder, liquid, rectal suppository, suspension	<1 mo: 10-15 mg/kg >1 mo-12 y: 10-15 mg/kg	- Effective for mild to moderate pain - Staple of pain management	- Can cause liver damage
Ibuprofen: tablet	6 mo-11 y: 10 mg/kg	See above	- Can cause GI discomfort, irritation, ulcers, bleeding, perforation
Topical Analgesics			
Antipyrine 5.4%/benzocaine 1.4%: solution	Infants/children: fill ear canal	- Temporary additional benefit over acetaminophen or ibuprofen in persons >5 y	- Infants ≤3 mo might be very sensitive
Naturopathic: Otikon Otic Solution®	Infants/children: fill ear canal	- Effective as anesthetic drops - Comparable to amocaine/phenazone drops in patients >6 y	- Naturopathic: strength depends on growing/harvesting conditions of herbs

GI = gastrointestinal. Data from prescribing information for each agent; AAFP/AAOHNS/AAP.³

concentrated solution directly to the site of infection. Topical therapy also resolves the treatment gap caused by the lack of systemic agents effective against *Pseudomonas aeruginosa*.

Topical otic fluoroquinolones are generally recommended as first-line treatment (Table 6). Ofloxacin otic is indicated only for children with perforated eardrums or tympanostomy tubes. Ciprofloxacin otic is indicated for children aged 6 months and older. Topical preparations should be used for 7 to 10 days in children with chronic suppurative otitis media. Shake the solution and warm the vial in your hands before instilling into the ear to avoid causing dizziness.

Managing Antibiotic Anxiety

For the patient or parent who expects antibiotics, education and review of the new evidence-based guidelines are important to include in the discussion. One way to open the conversation is to say, “The good news is, we DON’T need to use antibiotics!” Schedule either a follow-up phone call or an office visit for 2 to 3 days later, explaining that if there is no improvement, you will reevaluate then and may modify the treatment to include antibiotics. Another strategy that may be useful for selected patients who meet the criteria for watchful waiting is to give them a written “Rx to Go” with specific instructions as to when to start the antibiotic (eg, if pain worsens or fever escalates). The patient or parent gains a sense of some control over the decision-making and may feel less anxious about

Table 3. SYSTEMIC ANTIBIOTICS FOR MANAGING AOM IN CHILDREN WITH NO PENICILLIN ALLERGY

Agent	Approved Dosage	Advantages	Disadvantages
Amoxicillin: capsules, chewable tablet, oral suspension	<i>Infants ≤12 weeks:</i> ≤30 mg/kg/d <i>Infants >3 mo:</i> 20 mg/kg/d-45mg/kg/d, depending on severity	- First-line drug - Effective against <i>S pneumoniae</i> - Inexpensive - Well tolerated - Safe	- Do not use if there is urinary tract infection or purulent conjunctivitis - Not indicated for recurrent AOM
Amoxicillin/clavulanate ^a : tablet, chewable tablet, powder for oral suspension	<i>Children ≥40 kg:</i> Tablet, 250 mg-875 mg, depending on severity <i>Children ≥12 wk:</i> Suspension, 20 mg/kg/d-40 mg/kg/d, depending on severity <i>Neonates and infants ≤12 wk:</i> 30 mg/kg/d <i>Children ≥3 mo:</i> Suspension (600 mg): 90 mg/kg/d	- First-line choice in severely ill children - Protects against β-lactamase positive <i>H influenzae</i> or <i>M catarrhalis</i> - Clavulanate inactivates a wide range of β-lactam enzymes found in bacteria resistant to penicillin and cephalosporins	- Must be taken with food to reduce GI intolerance

Data from prescribing information for each agent; AAP/AAFP¹; Ramakrishnan K et al.²

not receiving antibiotics right away. This approach can be particularly useful prior to a holiday or long weekend when parents may feel they are “on their own.” Letting parents/patients know that you are available and a partner in their care creates an environment of trust, which is essential in these cases.

Susan Tiso, MN, FNP-BC

Other Medications

Although antihistamines and oral decongestants can help alleviate nasal congestion related to allergies, they may prolong MEE and thus are not recommended. They should be particularly avoided in children because of an increased risk for adverse effects.

Table 4. SYSTEMIC ANTIBIOTICS FOR MANAGING AOM IN CHILDREN WITH PENICILLIN ALLERGY, NO URTICARIA OR ANAPHYLAXIS

Agent	Approved Dosage	Advantages	Disadvantages
Cefdinir: oral suspension, capsules	<i>Children 6 mo-12 y:</i> 7 mg/kg/d OR 14 mg/kg/d	- Effective against aerobic gram-positive and gram-negative bacteria - Works against many organisms resistant to cephalosporin	- Can cause rash, GI upset - Inactive against enterobacter, most strains of enterococci, <i>Pseudomonas aeruginosa</i>
Cefpodoxime: tablet, oral suspension	<i>Children 2 mo-12 y:</i> 5 mg/kg/d (max 200 mg/d)	- Effective against aerobic gram-positive and gram-negative bacteria - Works against many organisms resistant to cephalosporin - Once-daily dosing	- Inactive against enterobacter, most strains of enterococci, <i>Pseudomonas aeruginosa</i>
Cefuroxime: caplet, oral suspension	<i>Children old enough to swallow whole tablet:</i> 250 mg <i>Children 3 mo-12 y:</i> 30 mg/kg/d	- Available as tablet and oral suspension; suspension preferred	- Pills exceptionally bitter; avoid crushing whole pill, use oral suspension
Ceftriaxone: injection	<i>Children:</i> 50 mg/kg/d	- Option for patients with severe infection, persistent/recurrent AOM, vomiting, compliance issues - Highly stable in presence of β -lactamases of gram-positive/gram-negative bacteria - Active against anaerobes, aerobic gram-negative bacteria, many strains of <i>Pseudomonas aeruginosa</i>	- Administered parenterally - Not effective against MRSA, group D streptococci, enterococci

Data from prescribing information for each agent; AAP/AAFP¹; Ramakrishnan K et al.²

Corticosteroids similarly offer no benefit for children but may be helpful in adults with persistent AOM and allergies.

Persistent and Recurrent AOM

If symptoms do not improve within 48 to 72 hours, consider reevaluation

to rule out other causes. If AOM is not improved after a few days of observation and symptom management, start amoxicillin unless allergy to penicillin exists; if so, use a drug listed in Tables 4 and 5.

- If the child became worse while on amoxicillin or if infection with

Table 5. SYSTEMIC ANTIBIOTICS FOR MANAGING AOM IN CHILDREN WITH PENICILLIN ALLERGY AND URTICARIA OR ANAPHYLAXIS

Agent	Approved Dosage	Advantages	Disadvantages
Azithromycin: oral suspension	<i>Children 6 mo-16 y:</i> single dose 30 mg/kg 3-d course 10 mg/kg 1 x daily/3d 5-d course Day 1: 10 mg/kg/d Days 2-5: 5 mg/kg/d	- 1 dose effective as longer courses - Effective against aerobic/facultative gram-positive organisms	- Antimicrobial activity reduced with increasing pH - Cross-resistance with erythromycin-resistant gram-positive organisms: ineffective against <i>Enterococcus faecalis</i> and MRSA - Contraindicated in children allergic to erythromycin, macrolides, ketolides
Clarithromycin: tablet	<i>Children >6 mo:</i> 15 mg/kg/d	- Effective against a variety of anaerobic and aerobic gram-negative/gram-positive organisms	- May cause GI irritation
Clindamycin ^b : capsules, oral suspension	<i>Adults:</i> 150-450 mg every 6 h <i>Children ≥1 mo:</i> 2-5 mg/kg/every 6h OR 2.7-6.7 mg/kg/every 8h <i>Children <10 kg:</i> 37.5 mg	- Recommended for children who do not respond to other antibiotics - For serious infection related to anaerobic staphylococci, streptococci, pneumococci or infection due to penicillin-resistant <i>S pneumoniae</i> - Appropriate for all ages	- Can irritate the esophagus; give with full glass of water

Ceftriaxone (see Table 4)

IM = intramuscular; IV = intravenous; MRSA = methicillin-resistant *Staphylococcus aureus*.

^a250-mg chewable tablets and 250-mg tablets do not contain the same amount of clavulanic acid; they are not interchangeable. The 600-mg (5 mL) suspension does not contain the same amount of clavulanic acid as other suspensions (5 mL). The suspensions are not interchangeable; See package inserts for specifics. ^bFor children who do not respond to second-line antibiotics, clindamycin treatment can be supplemented with tympanocentesis. Data from prescribing information for each agent; AAP/AAFP¹; Ramakrishnan K et al.²

β -lactamase-positive *H influenzae* or *M catarrhalis* is possible, switch to amoxicillin/clavulanate

- If the child was receiving amoxicillin/clavulanate, switch to a 3-day course of parenteral ceftriaxone. This option is also recommended for children who are vomiting or who are unresponsive to other antibiotics¹
- If AOM persists, arrange for tympanocentesis to confirm the cause of infection. If this is unavailable, give clindamycin in case the child is infected with penicillin-resistant pneumococcus. If there is still no response, arrange for tympanocentesis. Gram stain, culture, and sensitivity studies will be necessary to identify the cause of infection¹

Children with recurrent AOM usually improve with close observation. Antibiotic prophylaxis is generally

unnecessary, but preventive measures are prudent and include breast feeding for at least 6 months, avoiding supine bottle feeding, discouraging pacifier use after 6 months of age, eliminating exposure to second-hand smoke, ensuring influenza vaccination during the appropriate season, and altering daycare attendance patterns, particularly during outbreaks of respiratory illness.¹

In children with tympanostomy tubes or a perforated tympanic membrane, persistent AOM (3 months or longer) is known as chronic suppurative otitis media without cholesteatoma. It is usually caused by *P aeruginosa* or *S aureus*. Management is directed at resolving symptoms and preventing hearing loss. An extended course of a topical otic fluoroquinolone is often recommended for these children.⁵

Table 6. TOPICAL ANTIBIOTICS FOR MANAGING AOM IN CHILDREN WITH TYMPANOSTOMY TUBES

Agent	Approved Dosage	Advantages	Disadvantages
Ciprofloxacin 0.3% + dexamethasone 0.1%: solution	Children ≥ 6 mo: 4 drops 2 \times daily	- Reduces inflammation; combats infection - Fast acting	- Side effects can include vertigo, tinnitus
Ofloxacin 0.3%: solution	Children 1-12 y: 5 drops 2 \times daily	- Effective against wide range of gram-negative and gram-positive organisms, including <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>E coli</i>	- Some cross-resistance between ofloxacin and other fluoroquinolones, but not other antibiotics
Hydrocortisone/neomycin/polymyxin B: solution	Children: 4 drops, 3-4 \times daily	- Reduces swelling, redness, itching	- Long-term use can damage hearing (neomycin)

Data from prescribing information for each agent; AAP/AAFP.¹

Role of Vaccines in Preventing AOM

Immunoprophylaxis with killed or live attenuated intranasal influenza vaccines helps to prevent AOM during respiratory outbreaks or seasonal illnesses. Most studies documenting efficacy have involved children older than 2 years. Killed vaccine does not prevent AOM in infants and toddlers. Pneumococcal conjugate vaccines can help prevent vaccine-serotype pneumococcal otitis media, but they only reduce the incidence of AOM by about 6%.

OTITIS MEDIA WITH EFFUSION

Overview

OME is defined as fluid in the middle ear that exists without signs or symptoms of acute ear infection (Figure 5). OME can accompany upper respiratory tract viral infection, or it can develop before or after AOM. Each year, approximately 2.2 million cases of OME are diagnosed in the United States, costing around \$4 billion.



Figure 5. Serous otitis media with air-fluid levels.

Natural History

OME is a disorder caused by eustachian tube dysfunction (ETD). ETD places the tympanic membrane under negative pressure which may cause weakened areas of the membrane to form retraction pockets or cause the membrane to rest against the incus. Either situation may lead to the formation of cholesteatoma or erosion of the ossicles.³

OME can also be a consequence of inflammation in persons with AOM. It usually affects children between the ages of 6 months and 4 years. By the age of 1 year, evidence suggests that over half of all children will have experienced OME.³ Risk factors include hearing loss of more than 30 dB, tympanostomy tube placement, hypertrophied tonsils or adenoids that obstruct the eustachian tubes, onset during summer or fall, nasal septum deviation and airway obstruction, or craniofacial or genetic anomalies (Down syndrome, cleft palate, etc).^{2,3}

OME will usually resolve spontaneously in 3 to 4 months, especially when it follows AOM. About 30% to 40% of children have recurrent OME, and 5% to 10% have episodes that last a year or longer.³ The persistent middle ear fluid interferes with tympanic membrane mobility and causes a conductive hearing loss. For this reason, a primary objective of disease management is to prevent hearing loss and structural damage to the tympanic membrane.

Any abnormality in position of the tympanic membrane, retraction pocket

formation, or concern for hearing loss should be evaluated with audiometry and referral to an otorhinolaryngologist.

Clinical Evaluation

Patient Presentation

Though OME is not painful, patients typically have diminished hearing. In infants, this may present as failure to respond to voices or environmental sounds. Infants may also be irritable or sleep-deprived, and they may rub their ear(s). In older children, OME might be indicated by deteriorating academic performance, delayed speech or language development, and clumsiness or poor balance. Adults with OME may report sensations of fullness or heaviness and may describe hearing crackling or popping sounds. They might also report sensing a foreign body in the ear(s).

History

Ask about risk factors, especially a recent history of AOM, chronic otitis media, allergies, or upper respiratory tract viral infection. Ask the parents if the child's tonsils and adenoids have been causing any problems. Also inquire about recent travel and recent and/or ongoing exposure to cigarette smoke or other environmental irritants.

Physical Examination

The physical examination is similar to that for patients with AOM. Pneumatic otoscopy is the gold standard for diagnosing OME because it has the best

balance of sensitivity and specificity, is readily available, and is inexpensive.³ Tympanometry provides additional information when the results of otoscopy are equivocal. It detects the presence or absence of fluid/pressure in the middle ear space, and indirectly measures eustachian tube and middle ear function. Audiometry is indicated for children with suspected hearing deficit. Children aged 4 years and older can be tested in the primary care office, while those younger should be referred to an otorhinolaryngologist.

Findings from the physical examination that support the diagnosis of OME are: **External examination.** Signs of allergy: allergic shiners, boggy nasal turbinates, mucoid drainage/rhinorrhea, watery eyes, injected conjunctivae. Enlarged tonsils and/or adenoids and mucoid postnasal drainage are also characteristic.

Pneumatic otoscopy. Tympanic membrane is dull and cloudy, and mobility is distinctly impaired. The middle ear may have a visible bubble. About 5% of children will have distinct redness of the tympanic membrane. Purulent exudate is usually absent. Children with chronic otitis media can have thickening and scarring of the tympanic membrane (tympanosclerosis) (Figure 6).

Tympanometry. Potential tracings:

- Type A: normal eustachian tube and middle ear
- Type B with low volume: positive for middle ear fluid

- Type B with high volume: tympanic membrane perforation
- Type C with high negative pressure: eustachian tube inflammation and dysfunction

Audiometry. Conductive hearing loss

Tympanometry Tip

It is very important to have a good seal between the tympanometer and the external auditory canal in order to properly perform this examination; using an otoscopic speculum with a soft, pliant rubber tip is helpful to ensure a good seal.

Susan Tiso, MN, FNP-BC

Risk Factors for Negative Sequelae

Certain children are at increased risk for undesirable sequelae from OME. These include children who became ill during the summer or fall, have intact adenoids, have had tympanostomy tubes, or have a hearing loss of more than 30 dB in their better ear.³

In these children, ongoing inflammation can produce structural damage to the tympanic membrane. The membrane and adjacent mucosal linings

can also undergo reactive changes.

Underventilation of the middle ear, with negative pressure, can lead to focal retraction pockets, generalized atelectasis, and cholesteatoma (Figure 7). Extra vigilance is prudent in this group.³

Children who develop OME sequelae, such as hearing loss, speech delay, or tympanic membrane abnormalities, should be considered for tympanostomy tube placement to relieve the negative middle ear pressure and middle ear fluid and to restore the position of the tympanic membrane.

Management

Initial Care

Most cases of OME resolve spontaneously. However, watchful waiting for at least 3 months is recommended for otherwise healthy children who are not at risk of speech, language, or learning problems. Watchful waiting in these children is particularly warranted in cases of new-onset OME, OME that follows AOM, or when the tympanogram changes from a type B (flat) to a non-B curve on follow-up.

Bilateral OME lasting 3 months or longer will resolve within 6 to 12 months in about one-third of children. These patients should be monitored with periodic otoscopy and tympanography.³

Treatment for OME is recommended only if persistent, clinically significant benefits are possible beyond those achieved with natural healing.



Figure 6. Tympanosclerosis.

There are no data to suggest that antihistamine-decongestant combinations, oral corticosteroids, or antimicrobials deliver any long-term benefit, and they expose the child to unnecessary risk of adverse effects. Prolonged use of antibiotics also contributes to transmission of resistant bacterial strains to other children and family members.¹

Reassurance and Maybe, Referral

Reassurance and close follow-up can help patients/caregivers who are anxious about the prolonged nature of OME. When the patient or parent is overly concerned, improvement has been less than expected, or children have hearing loss or speech delay, consider referring to a specialist.

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Follow-up Care for Persistent OME

Children. If OME is asymptomatic and the child is at low risk for lingering infection or undesirable sequelae, continue with observation.³ Plan to reexamine the child every 3 to 6 months until effusion is no



Figure 7. Tympanostomy tube with cholesteatoma.

longer detected, pneumatic otoscopy reveals structural abnormalities of the eardrum or middle ear, or audiometry identifies significant hearing loss.

Any child with prolonged (3 months or longer) OME or structural damage needs a hearing test. The results will determine the next course of action (see Table 7).

Adults. Adults with OME present their own set of concerns. Referral to an otorhinolaryngologist for more testing is prudent when there is unilateral effusion in a patient with no previous ear problems; persistent or recurrent effusion; severe chronic eustachian

Table 7. HEARING TEST RESULTS AND RECOMMENDED STEPS

Score	Status	Recommendation
≤20 dB	Normal hearing	- Repeat hearing test in 3-6 mo if OME persists
21-39 dB	Mild hearing loss	- Arrange for comprehensive audiologic evaluation - Surgery might be necessary - Repeat testing in 3-6 mo if OME is present at follow-up
≥40 dB	Moderate or worse hearing loss	- Arrange for comprehensive audiologic evaluation - Persistent hearing loss requires surgery

AAFP/AAOHN/AAP³

tube dysfunction; suspicion of cancer; or hearing loss.

Surgery

For children with mild to moderate hearing loss who may require surgery, the choice of procedure will depend on the clinical picture (see Table 8). The clinician also needs to consider parent/caregiver concerns and opinions about the potential benefits and risks of surgery. Surgery is indicated for children with OME that has lasted 4 months or longer and who have persistent hearing loss or other signs/symptoms of a speech, language, or learning deficit; are at risk with recurrent or persistent OME, regardless of hearing status; or have sustained structural damage to the tympanic membrane or middle ear. Tympanostomy tube insertion, which

reduces effusion by more than half, is the preferred initial procedure.³

OTITIS EXTERNA

Overview

Otitis externa (OE), sometimes called “swimmer’s ear,” is defined as inflammation of the outer ear and ear canal. Approximately 4 of every 1000 Americans will suffer from OE each year; 10% of people are believed to have been affected at some time. OE is more common among adults but does affect children. The pathogen is usually bacterial but can be fungal or viral, and it is generally confined to the tissues of the external auditory canal.⁶ Chronic OE is usually the result of dermatologic conditions or allergies.

Natural History

Disruption of the ear canal’s waxy or epithelial protective mechanisms can

Table 8. SURGICAL PROCEDURES AND INDICATIONS FOR CHILDREN WITH OME^a

Procedure	Indication
Tympanostomy tubes (preferred first step)	<ul style="list-style-type: none"> - Suitable for children <3 y - Reduce effusion by more than half - Significantly improve hearing while tubes are patent
Adenoidectomy	<ul style="list-style-type: none"> - Recommended if OME recurs after tubes are removed or there is a clear indication (ie, nasal obstruction, chronic adenoidal inflammation) - Higher risk, more invasive than tube insertion, but can reduce need for repeat surgery 50% - Greatest benefits seen in children ≥3 y
Adenoidectomy + myringotomy ^b	<ul style="list-style-type: none"> - Recommended for children ≥4 y

^aTonsillectomy, not mentioned in table, is higher risk and offers little/no benefit; ^bMyringotomy without adenoidectomy provides temporary ventilation because incisions heal quickly.

AAFP/AAOHNS/AAP.³

allow pathogens to invade the tissues, causing inflammation of the ear canal. The primary pathogens responsible for OE are:

- Bacteria: *P aeruginosa*, *S aureus*, *Staphylococcus epidermidis*
- Fungi: *Aspergillus* sp, *Candida* sp
- Viruses: Herpes zoster

Excessive exposure of the ear canal to water, which strips the canal of cerumen and elevates pH, is the leading risk factor for OE. Other risk factors are surfer's ear (bony constriction of the ear canal); use/overuse of cotton swabs or other objects to clear the ear canal; chronic skin conditions, such as atopic dermatitis, seborrheic dermatitis, psoriasis, and keratin abnormalities; trauma that breaks the skin; compromised immune system; systemic lupus erythematosus (SLE); and diabetes.

OE rarely resolves spontaneously and, if neglected, can lead to serious complications. Malignant OE is a concern among persons who are immunocompromised or have diabetes. Other complications include necrotizing OE and systemic spread of infection.⁶

Clinical Evaluation

Patient Presentation

Presenting symptoms vary according to the length of time since infection began.⁷

Within the first week. Patients may have mild to severe discomfort. The external auditory canal is swollen and itchy, feels full, and emits an odorless secretion. Hearing is diminished.

Within 2 weeks. The patient has purulent discharge from the ear. Erythema is increased, and the canal is markedly swollen. Chewing, pressing on the tragus, and auricular movement are all painful.

After 2 weeks. The ear is intensely painful and emits marked discharge. The canal is completely obstructed. External ear signs include preauricular and postauricular lymphadenopathy, parotitis, fever, and auricular cellulitis.

History

The history is aimed at uncovering OE risk factors. This includes asking questions about any recent trauma, diving, or swimming and determining whether the patient has inserted objects into the ear. The history also probes for predisposing medical conditions, such as diabetes; immune suppression; SLE; or skin conditions such as dermatitis or psoriasis.

Physical Examination

Based on findings from the history, it is prudent to check for systemic problems that can contribute to OE. For instance, a blood glucose level or hemoglobin A1C is appropriate if diabetes is suspected. An antinuclear antibody test is appropriate for patients with SLE or other autoimmune disease. The skin should be examined for evidence of atopic or seborrheic dermatitis, psoriasis, or keratoses. Lesions in the external ear canal arising from these conditions can allow bacteria and fungi to invade the skin.

When examining the head and neck area, look for evidence of trauma. Be alert for signs of infection or inflammation which may affect the mastoids and cause swelling of the cervical as well as the pre- and postauricular lymph nodes. Also examine the mouth, larynx, sinuses and the nose for signs of infection. Examination of the ear should focus on 3 specific structures:

Outer ear. Pain is exacerbated by touching the external ear or tragus; this maneuver is essential to confirm an OE diagnosis

External ear canal. The canal will be red, swollen, and painful and may be completely blocked; it may contain debris, such as material from a reproducing fungus.

Tympanic membrane. If membrane is visible (a swollen canal can block view), look for multiple small holes. If AOM is

also present, the membrane will be red from inflammation.

If there is blockage, avoid cleaning the canal as instruments may cause damage. Do not flush the canal if the tympanic membrane appears perforated. The activity can disrupt the ossicles and lead to vertigo, tinnitus, and potential hearing loss. Leave debris in place and reexamine the patient frequently until secretions clear or loosen.⁷

When examining the ear canal, take special note of otorrhea. Its appearance/odor provides clues to the cause of the problem (Table 9).

OE Offers Reliable Clues

The diagnosis of OE is fairly straightforward, and you can usually find factors in the history that will contribute, such as impaired glucose tolerance

Table 9. DIAGNOSTIC CLUES FROM OTORRHEA IN OE

Appearance/Odor	Probable Diagnosis
Clear, thin, watery	Cerebrospinal fluid leak
Intermittent presence of purulent mucous	Chronic otorrhea
Green, foul-smelling	<i>Pseudomonas aeruginosa</i> infection
Fluffy, white or off-white common; other colors include black, gray, bluish green, yellow	<i>Candida</i> fungal infection
Fluffy with small black or white conidiophores on white hyphae	<i>Aspergillus</i> fungal infection
Purulent, smelly mucous	Osteomyelitis
Scanty, sometimes thick white mucous	Acute OE
Bloody discharge and possible debris	Chronic OE
Purulent white to yellow mucous	Otitis media with perforated tympanic membrane
Clear mucous	Otitis media related to allergies
Bloody mucous	Trauma

Handley RT.⁶

or diabetes. Younger patients often say that they spend prolonged periods of time wearing single or double earphones—talking on the phone or listening to music. Older patients may have eczematous conditions that cause pruritus and frequent scratching of the ear canals, provoking infections. During the history, it can be helpful to ask whether the patient notices a wet sensation in the ear canal or any drainage from an ear on a pillowcase.

Susan Tiso, MN, FNP-BC

Management

Treatment for OE depends on the clinical picture. Antimicrobial ototopical agents offer the advantages of targeted, highly concentrated treatment and fewer side effects than may occur with systemic antibiotics.

Topical otic fluoroquinolones. These are easy and safe to use; ofloxacin is US Food and Drug Administration–approved for use when the tympanic membrane is ruptured. Treatment should be continued at the manufacturer’s recommended dosage for 3 days beyond the resolution of symptoms or 10 to 14 days for more severe infections. Adding a corticosteroid can help reduce ear swelling, but it can also cause sensitization. A combination agent containing both an otic fluoroquinolone and corticosteroid is available.

Aminoglycosides. Often associated with ototoxicity and dermatitis, aminoglycosides cannot be used when the tympanic membrane is perforated. They are usually prescribed with a broad-spectrum

β -lactam antibiotic for severe infection suspected to be caused by gram-negative bacillus.

Acid wash. This is appropriate for simple fungal infections. If infection persists after topical treatment, it may be necessary to add a broad-spectrum oral triazole (itraconazole, fluconazole).

In some cases, accumulation of fungal debris can be substantial. Office-based debridement can often speed recovery. Systemic agents should be added if infection extends to structures outside the ear. Unless otherwise specified, treatment at the manufacturer’s suggested dosage for 3 days after symptoms resolve is recommended—usually for a total of 5 to 7 days. Treatment options are summarized in Table 10.

Ear Wick Delivery

An ear wick works well in patients who do not have severe auditory canal edema with obstruction. The wick acts as a sponge and absorbs the otic antibiotic drops, distributing the medication to the auditory canal tissue and preventing it from running out after instillation. The patient is instructed to leave the wick in place for 2 days while instilling otic drops and then to return to the office for wick removal.

Susan Tiso, MN, FNP-BC

Complications

Resistant OE may indicate a systemic issue, such as diabetes, cancer, malnutrition, or another infection, and calls for timely reevaluation. Concomitant AOM can also render OE more difficult to

Table 10. TOPICAL MEDICATIONS FOR MANAGING OE

Agent	Approved Dosage	Advantages	Disadvantages
Acid Wash			
2% acetic acid, 1% hydrocortisone OR 50% acetic acid + hydrocortisone + 50% alcohol (90%): topical preparation, solution	<i>Children >3 y:</i> 1-2 drops in canal every 4-6 h	- Effective for bacterial, fungal infections	- Can cause dizziness; warm fluid by holding the bottle for a few minutes before instilling into ear
Antibiotics			
Ciprofloxacin 0.3%/ dexamethasone 0.1%: solution	<i>Children ≥6 mo:</i> 4 drops every 12 h	- Only fixed combination fluoroquinolone/steroid - Effective against <i>Pseudomonas</i> , Streptococci, methicillin-resistant <i>Staphylococcus aureus</i> , <i>S epidermidis</i> , most gram-negative organisms - Dexamethasone relieves swelling, pain	- Not effective against anaerobes
Ofloxacin 0.3%: solution	<i>Children 6 mo-13 y:</i> 5 drops once daily <i>Children ≥13 y:</i> 10 drops once daily	- Easy, safe to use - Effective against wide range of gram-negative and gram-positive pathogens - No cross-resistance with other classes of antibiotics	- Can cause dizziness; warm fluid by holding the bottle for a few minutes before instilling into ear
Hydrocortisone + neomycin + polymyxin B: solution	<i>Adults:</i> 4 drops, 3-4× daily <i>Children >2 y:</i> 3 drops, 3-4× daily	- Corticosteroid component alleviates inflammation	- Do not use with ruptured tympanic membrane - Prolonged (>10 d) use can cause hearing loss
Antifungals			
Clotrimazole 1%: solution	<i>Children:</i> Apply thin film over area 2× daily	- Broad-spectrum antifungal - Safe for children	- Can cause stinging and irritation of the skin
Tolnaftate 1%: liquid, cream, gel	<i>Children >2 y:</i> Apply thin film over area 2× daily	- Broad-spectrum antifungal	- In children <2 y, medication needs to be followed closely
Fluconazole: tablet	<i>Children 6 mo-13 y:</i> 3-12 mg/kg/d	- Wider-spectrum triazole antifungal - Indicated when infection persists - Appropriate for fungal superinfection	- Monitor liver function to check for hepatotoxicity

Data from prescribing information for each agent; Handley RT.⁶

treat. Of special concern are the complications of malignant OE and furuncle. **Malignant OE.** This condition occurs when the invading pathogen—usually *P aeruginosa*—spreads to the mastoid or temporal bone, cartilage, nerves, and blood vessels. Signs of malignant OE to watch for are pain that is disproportionate to symptoms, necrosis or granulation of ear canal skin, body temperature higher than 102.2°F (39°C), and facial paralysis, vertigo, or meningial signs.

When malignant OE is suspected, immediately refer the patient to a specialist. Treatment involves a combination of antibiotics and surgery.

Furuncle. This superficial abscess in the lateral third of the external ear canal is usually caused by *S aureus*. Treatment consists of systemic and topical antibiotics plus drainage and warm compresses.

Preventing OE

Preventing OE is relatively straightforward:

- Avoid frequent or aggressive insertion of objects (including cotton swabs) in the ears
- Use ear protection during water activities, but avoid hard or poorly fitting earplugs
- Cotton balls covered in petroleum jelly are soft, inexpensive, and hygienic substitutes for other types of ear protection

- Dry the ears after swimming with either a dryer or a dilute solution of acetic acid
- Avoid swimming in polluted water
- Avoid shampooing at first sign of OE
- If diabetic, control blood sugar levels
- When using headphones, choose small ones or ear buds that fit well and won't scratch the ear canal

All photographs in *Part II: Otitis* courtesy of Wayne E. Berryhill, MD.

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