Drainage from the ear, or otorrhea, is commonly encountered in pediatric practice and can present a diagnostic and therapeutic quandary to the pediatrician. Otorrhea may result from many causes, including soiling of ears with tympanostomy tubes or tympanic membrane perforations, otitis externa, cholesteatoma, and foreign bodies. Less common etiologies include cerebrospinal fluid otorrhea from congenital malformations or trauma, otitic candidiasis, and malignancy.

Although the diagnosis cannot always be established at the first visit, a general approach to the draining ear is possible that permits timely elucidation of the etiology and appropriate management or referral if necessary. In this article, we offer such an approach and discuss rational management strategies for the common causes of otorrhea in children.

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When evaluating a child with otorrhea, a thorough history of the chief complaint and past otologic events often suggests an etiology (Sidebar 1, see page 846). Bilateral drainage occurs most commonly with tympanostomy tubes or tympanic membrane perforations (Figure 1, see page xxx) but may also occur in unusual cases of otitis externa (swimmer’s ear). A history of swimming or upper respiratory infection preceding the onset of otorrhea is common with tubes or tympanic membrane perforation. Bilateral cholesteatoma is a rare occurrence. Long-standing drainage usually suggests a chronic middle ear process such as cholesteatoma or granulation tissue.

Chronic drainage also may result when common infectious agents are inadequately treated topically or systemically; when yeast, fungi, or mycobacteria are present; or when the patient is unable to mount an appropriate immune response. Bloody drainage usually suggests the presence of granulation tissue or trauma to the ear canal, although severe otitis media also may occasionally be associated with this finding. Pain on palpation of the auricle most commonly is associated with otitis externa but may be present when prolonged drainage of any kind has caused irritation of the external ear. Deep pain may be associated with complications of otitis media.

CAUSES OF OTORRHEA

Tympanostomy Tube Otorrhea

Tympanostomy tube otorrhea is the most common type of otorrhea encountered, occurring at least once in up to 75% of patients within the first 12 months after tubes are inserted. In a recent meta-analysis of patients who underwent tube insertion, otorrhea was characterized as early (less than 2 weeks after placement) in 16% and late in 26%, and recurrent in 7.4% and chronic in 4%. Early tube otorrhea most commonly is associated with mucoid or purulent effusions at surgery and far less commonly with serous or absent effusion. It is more likely related to middle ear conditions at surgery than to sterile preparation of the ear canal.

Post-tympanostomy tube otorrhea may be reduced by the use of antibiotic eardrops at the time of tube placement and by saline irrigation of the middle ear through the myringotomy at surgery. Bacterial biofilms have been implicated as a possible etiology in cases of recurrent and chronic otorrhea.

Usually seen during episodes of acute upper respiratory infection, tube otorrhea is precipitated by the usual otitis media organisms (Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis). However, within hours to days, Pseudomonas aeruginosa may become the predominant organism. In children older than 3, middle ear organisms are cultured less commonly and Staphylococcus aureus is found more frequently. In the summer, when otorrhea may be associated with infection from external sources, involvement of nasopharyngeal pathogens is even less likely.

In most cases, tube otorrhea is painless and resolves spontaneously within a few days. In children 6 or younger treated with oral placebo and daily suctioning of the tube, about one-third resolved by day 4. In more persistent or symptomatic cases, topical or systemic antimicrobial therapy may be indicated. When the drainage is bloody or fails to clear after ototopical therapy, granulation tissue often is present at the edge of the tube (Figure 2). This occurs in 5%
to 14% of patients whose tubes have been in less than 3 years, and the risk of developing granulation increases with tube longevity. Although granulation usually is present on the lateral surface of the eardrum, the tissue may also occupy the middle ear or even the lumen of the tube, rendering it ineffective.

The risk of otorrhea due to water exposure in patients with tubes has been addressed in a number of studies. In vitro models of tubes exposed to water suggest that pressures of 12.8 to 13.3 cm H₂O (equivalent to approximately 6 feet of depth below the surface) are required to push most types of water through the lumen of a standard tube. Most authors of in vivo studies have concluded that patients who swim on the surface and do not make deep dives have no increased risk of otorrhea with water exposure. Factors that may increase the risk of otorrhea due to water exposure include large lumen tubes or tympanic membrane perforations, soapy water (which decreases surface tension), lake water or water known to be contaminated, and swimming at depths below 2 to 6 feet. When these factors are present, the ear should be protected using commercially available ear plugs. Moldable putty plugs must be gently placed in the ear so as to avoid fragmenting the material deep in the ear canal. During periods of brief water exposure, cotton coated with petroleum jelly may provide adequate protection.

For those uncommon patients who are highly susceptible to otorrhea, limited water exposure or use of water precautions may be recommended. Otopical medications may be used after swimming, although these medications occasionally may cause discomfort when used in a dry middle ear.

**Otitis Externa**

Otitis externa is an infection of the external auditory canal most commonly preceded by mechanical or chemical damage to the normal protective barrier created by the skin and cerumen. The loss of protective films and secretions leads to elevated pH and an environment in which infecting organisms thrive. *P. aeruginosa* and *S. aureus* are the most common infecting organisms, although cultures from the canal may demonstrate *Escherichia coli*, streptococci, Aspergilli, or *Candida albicans*. Chronic or recurrent external otitis may result from fungal infection or from skin conditions such as eczema, seborrhea, or psoriasis. In cases of eczematous dermatitis of the ear canal, moist vesicle and pustules are seen acutely and crusts and scales form in ears affected chronically.

Although otorrhea is often present, the hallmarks of external ear infections are severe pain and a sense of fullness in the affected ear. When the ear canal is patent, cheesy debris due to desquamation may be found along the canal walls. In severe cases, the tympanic membrane may be obscured and associated postauricular swelling may be confused with mastoiditis. However, association with swimming or canal trauma, the absence of high fever, and pain with movement of the auricle are more typical of otitis externa. Equivocal cases should be referred for otolaryngologic evaluation.

**Chronic Suppurative Otitis Media (Without Cholesteatoma)**

Chronic suppurative otitis media (CSOM) is characterized by otorrhea through a perforation of the tympanic membrane. This disorder begins as a mucosal disease of the middle ear and mastoid due to soiling of the middle ear. Suppurative otitis is considered chronic after 6 weeks, when scarring, osteitis, and bone destruction may be present. In most cases, the drainage is painless; however, in the presence of bone involvement, otorrhea may be associat-
ed with deep pain and a foul smell. Advanced cases may involve intracranial complications.

The offending organisms in CSOM are much the same as seen in otitis externa, with *P. aeruginosa* being the most common isolate. However, many cultures demonstrate polymicrobial infections including gram-negative bacilli, *Staphylococcus aureus*, and *anaerobes*.22,23,25 The presence of middle ear granulation may also suggest infection by mycobacteria.26 Other uncommon causes of CSOM include tuberculosis, syphilis, histiocytosis, and rhabdomyosarcomas.24

Recent reports suggest that medical management of CSOM is successful in 75% to 89% of patients.22,23,25,27 A 10- to 14-day course of systemic antibiotic therapy is recommended, accompanied by daily aural toilet using the otologic microscope. However, in studies by Kenna and colleagues, among children who failed medical management, 36% to 50% had occult cholesteatoma at the time of surgery.22,27 These data suggest that the success rate of medical management in patients with true CSOM is actually higher. However, CSOM and cholesteatoma may simply represent two points on the spectrum of ear disease and, in refractory cases, the patient should be examined meticulously by an otolaryngologist for abnormal tissue within or extruding from the middle ear.

Computer tomography scanning may be useful in evaluating the extent of the soft tissue disease and biopsy of this tissue through the perforation can occasionally be performed in the office setting if necessary for diagnosis. Once the diagnosis is established, tympanomastoidectomy is often necessary for complete removal of the cholesteatoma or soft tissue and improve ventilation.

**Granular Myringitis**

Granular myringitis is characterized by clear or purulent otorrhea associated with flat granulations on the surface of a thickened but intact tympanic membrane. This disorder may be seen in patients with otitis externa, or may present separately. Frequently, the etiology cannot be established. Treatment consists of debridement of the ear and treatment of the granulations with caustic or antiseptic agents, such as silver nitrate, trichloroacetic acid, gentian violet, or steroid preparations.

**Acute Otitis Media**

Not infrequently, acute otitis media presents with an acute perforation and otorrhea. The diagnosis can usually be made based on a history of fever and symptoms of upper respiratory infection associated with severe otalgia that suddenly resolved when the ear began draining purulent material. The perforation is usually quite small and generally closes within a few days. As a result, ototopical medications are generally far less effective in managing such infections than are systemic agents. Patients should be reevaluated once the drainage has ceased to be certain that the perforation heals and the middle ear effusion clears spontaneously.

**Cholesteatoma**

Cholesteatoma, more properly termed “aural keratoma,” is the growth of squamous epithelium in the middle ear space. This condition is frequently associated with otorrhea, but the drainage is often mild, resulting in inadequate therapy and delayed referral. The mass consists of a matrix of differentiated squamous epithelium that grows by accumulation of desquamated material. A layer of granulation tissue surrounding the keratoma elaborates enzymes that cause the bony destruction seen in ears with this disease.

Aural keratoma generally is classified as either congenital or acquired. Congenital keratomas are thought to arise from epithelial rests within the middle ear. They are most frequently encountered as a white pearl in the anterosuperior quadrant behind an intact tympanic membrane. Destruction of the eardrum and otorrhea generally occur only in advanced stages after the keratoma has grown considerably. Acquired keratoma may result from deep, chronic retractions of the tympanic membrane, usually in the region of the pars flaccida (“primary acquired keratoma”), or from chronic perforation of the tympanic membrane resulting in ingrowth of squamous tissue (“secondary acquired keratoma”) (Figure 3, see page 847). Acquired keratoma is also a rare but potentially serious consequence of tympanostomy tube placement, following which the eardrum may be weak or perforated at the site of the extruded tube.28
collection of pearly white squamous debris associated with an irregular or perforated tympanic membrane, often in a superior location. The process is frequently obscured by a layer of purulent drainage or granulation tissue, as the keratomatous debris serves as an excellent culture medium for bacteria.

Treatment of the associated bacterial infection with ototopical medication often simplifies the diagnosis. Many patients have hearing loss on audiometric screening, especially in the presence of a large perforation or ossicular erosion. Some patients have remarkably good hearing, however, due to conduction of sound through the cholesteatoma to the oval window.

Once the diagnosis of keratoma is suspected, referral to the otolaryngologist is imperative. Delayed referral may lead to complications including facial nerve paralysis, semicircular canal erosion with labyrinthine fistula, ossicular erosion, periosteal abscess, lateral sinus thrombosis, and intracranial abscess. Computed tomography is necessary to define the extent and to plan the surgical removal of the disease. Tympanoplasty with or without mastoidectomy is usually necessary, including repair of the damaged eardrum.

**Foreign Body**

Although even foreign bodies of long duration are often asymptomatic, they occasionally present with unilateral otalgia and otorrhea, much like otitis externa. Parents are usually unaware that the drainage is associated with a foreign body, and the object is often apparent only after thorough debridement.

Once a foreign body is identified, the first attempt at removal is usually the best, and may be the last before a trip to the operating room or conscious sedation is necessary. Irrigation is to be avoided in most cases, since this may push the foreign body deeper and the child may become increasingly anxious. Some objects, such as beans, may expand in the presence of moisture making removal even more difficult. Referral to an otolaryngologist should be considered since removal may be difficult and complete inspection of the canal and tympanic membrane are necessary. If removal is undertaken, the shape, texture, and orientation of the object must be studied. A wide variety of instruments should be available, including: alligator forceps for objects with edges; Hartmann forceps and wax loops for round objects; and Rosen and right angle picks for soft foreign bodies and those with holes. A Baron suction tip is very useful to debride blood and to aid with the extraction. After removal, it is usually wise to prescribe a topical antibiotic-steroid mixture for any drainage and to reduce the inflammation created by the foreign body and the extraction procedure.

**Cerebrospinal Fluid Otorrhea and Perilymphatic Fistula**

Clear discharge from the ear is rare but may suggest the presence of a leak of cerebrospinal fluid (CSF) or perilymph. These disorders result from a violation of the normal bony contours of the ear due to trauma, congenital malformation, or erosive processes. In most cases, patients complain of aural fullness, and examination reveals fluid in the ear canal that reaccumulates when evacuated. Occasionally, such patients present with dizziness, hearing loss, or recurrent bouts of meningitis.

Diagnosis of a CSF or perilymph leak is made by sampling the fluid and by imaging studies. A fluid sample with a glucose concentration of approximate-
ly 60% of the serum value and a protein concentration of less than 200 mg/dL is most likely CSF or perilymph. β2 transferrin has also been described as a marker for perilymph;29,30 however, some investigators have questioned the reliability of this test.31,32 The location of a CSF leak may be established using computerized tomography with intrathecal contrast or nuclear scans with intrathecal radionuclides. CSF leaks may heal spontaneously, or may require exploration through a variety of approaches, depending on the cause and location of the leak.

**MICROBIOLOGY OF OTORRHEA**

While most pediatricians are familiar with the conditions favoring infection by otitis media organisms, the presence of *Pseudomonas* in the ear is often less well understood. *Pseudomonas* is an aerobic, motile gram-negative rod commonly found in moist environments such as water, sewage, and soil. In the ear, *P. aeruginosa* is rarely culturable unless there is infection present.33,34 Patients who develop otorrhea due to *Pseudomonas* tend to retain moisture in the ear canal due to stenosis or excessive cerumen, and the prevalence of *Pseudomonas* in the external canal is known to increase with increasing water exposure.33 Other sources of moisture in the ear canal that may be associated with *Pseudomonas* infection include humid air, perspiration from wearing tightly fitted hearing aid molds or hearing protectors, and drainage from the middle ear due to otitis media. Trauma to the canal skin can also lead to *Pseudomonas* infection, most likely due to interruption of the protective layers of cerumen and skin and to local pH changes. Based on biochemical and growth characteristics, strains isolated from patients with otitis externa more closely resemble those of *Pseudomonas* in its natural water habitat cultured from 49% of cases.36 Chronic otorrhea may also result from opportunistic infections by *Aspergillus* and *Candida* species.

In otitis externa, *P. aeruginosa* is the most common infecting organism (61%), although cultures from the ear canal often demonstrate a polymicrobial infection (44%).39 Chronic or recurrent external otitis may result from fungal infections; from skin conditions such as eczema, seborrhea, or psoriasis; or from poor aural hygiene or trauma in stenotic ear canals. In chronic suppurative otitis media (CSOM), the organisms are similar to those in otitis externa, with *Pseudomonas* being the most common isolate (37% to 84%).40,41 However, most cultures (5% to 58%) demonstrate polymicrobial infections, including gram-negative bacilli, *S. aureus*, and anaerobes.22,23,25,40,41 Uncommon causes of CSOM include tuberculosis and syphilis, as well as noninfectious causes such as histiocytosis and rhabdomyosarcoma.

**TREATMENT OF THE DRAINING EAR**

**The Initial Visit**

Debridement of the ear canal is unquestionably the most critical step in the diagnosis and management of otorrhea. In the presence of significant canal swelling or otorrhea, determination of the cause of the drainage is not possible, and the treating physician may be uncertain whether to treat the patient for otitis media or otitis externa. Furthermore, removal of the drainage is necessary so that applied ototopical medication can reach the target pathology.

Before debridement, the ear canal must be visualized adequately, to minimize canal wall trauma and optimize examination of the tympanic membrane. This is best accomplished using a headlight, which keeps the examiner’s hands free for retraction of the auricle.
instrumentation of the ear. Headlights serve a similar role in examination of the nose and throat and are an invaluable addition to any pediatric practice.

Debridement of the canal is performed using swabs or a small suction device. Suction is generally quicker, more effective, and less traumatic to the canal wall, but the noise may be frightening to some patients, and the necessary equipment is not available in most pediatric practices. Cotton-tipped applicators, self-made cotton swabs, or small calcium alginate swabs, on the other hand, clear the majority of the drainage with less trauma to the canal walls. However, debridement using this technique is often insufficient to afford an adequate view of the tympanic membrane. Irrigation of the canal with room temperature saline for this purpose should be performed with extreme caution due to the potential for vertigo from caloric stimulation, particularly in patients with tubes or perforations.

Once the source of the otorrhea has been established, topical antibiotic therapy is usually indicated. Selection of an appropriate ototopical and duration of therapy is addressed later in this article. If adequate visualization of the ear canal and tympanic membrane are not possible due to poor patient cooperation, a trial of ototopical medication is still reasonable prior to considering referral to an otolaryngologist. In the presence of tympanic membrane perforation or tympanostomy tubes, oral antibiotics are rarely indicated; otorrhea concentrations of antibiotics administered through the eardrum are 100 to 1,000 times greater than those achieved with systemic therapy and likely exceed the MIC90 (the minimum concentration at which 90% of tested strains are inhibited) for a longer time. The topical route also reduces the potential for alterations in bacterial flora at other sites and the likelihood of inducing bacterial resistance. Parents should be instructed to debride the ear with twisted tissue paper or cotton prior to administering drops and to let each drop settle through the canal before the next is given. Tragal pressure applied afterwards ensures that the medication reaches the middle ear space.

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**TABLE.**

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Antimicrobial</th>
<th>Solvent/Antiseptic</th>
<th>Steroid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloromycetin otic solution</td>
<td>Chloramphenicol</td>
<td>Propylene glycol</td>
<td>None</td>
</tr>
<tr>
<td>Ciloxan ophthalmic solution</td>
<td>Ciprofloxacin</td>
<td>Benzalkonium chloride</td>
<td>None</td>
</tr>
<tr>
<td>Cipro HC otic</td>
<td>Ciprofloxacin</td>
<td>Polyvinyl alcohol</td>
<td>Hydrocortisone</td>
</tr>
<tr>
<td>Ciprodex otic</td>
<td>Ciprofloxacin</td>
<td>Polyvinyl alcohol</td>
<td>Dexamethasone</td>
</tr>
<tr>
<td>Colymycin S otic</td>
<td>Neomycin, polymyxin B</td>
<td>Aqueous</td>
<td>None</td>
</tr>
<tr>
<td>Cortisporin otic solution</td>
<td>Neomycin, polymyxin B</td>
<td>Propylene glycol, HCl</td>
<td>None</td>
</tr>
<tr>
<td>Cortisporin otic suspension</td>
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<td>Propylene glycol, alcohol</td>
<td>Hydrocortisone</td>
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<tr>
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<td>Ofloxacin</td>
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<td>Lidex solution</td>
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<td>Clotrimazole</td>
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</tr>
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<td>Neomycin, polymyxin B</td>
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<td>Tobradex ophthalmic solution</td>
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<td>Vosol HC solution</td>
<td>None</td>
<td>Acetic acid, propylene glycol</td>
<td>Hydrocortisone</td>
</tr>
</tbody>
</table>
When swelling obscures the tympanic membrane or pain is severe, placement of an expandable methylcellulose otowick or sponge maximizes exposure of the canal walls to ototopical medication and reduces drainage through the tube or perforation if one is present (Figure 4, see page 849). After 2 to 4 days, the wick is removed and the drops may then be delivered directly to the external canal, as edema most likely will have subsided. The swelling should be reduced sufficiently within several days to complete the examination of the ear. Narcotic analgesics may be necessary for pain management during the first few days of treatment.

**Ototopic therapy**

Treatments for otorrhea during the past four centuries have included red lead, tree resin, frankincense, goose grease, cream, vermilion, cumin, olive oil, and hatet oil. The earliest ototopical antibiotic preparations included sulfathiazole ascorbate and sodium penicillin-sulfathiazole. Chloramphenicol, streptomycin, erythromycin, and aminoglycosides later became available in a variety of powders and solutions. In the 1960s, an ototopical containing neomycin (an aminoglycoside), polymyxin B (a polypeptide antibiotic), and hydrocortisone emerged as the preferred therapy for otorrhea. However, cases of neomycin allergy began to appear, presenting as erythema and swelling of the auricle with peeling of the skin. In addition, data from animal studies beginning in the late 1960s suggested all of these medications, as well as their carriers and solvents, have inflammatory and ototoxic potential. Toxic effects included inner and outer hair cell destruction, squamous metaplasia and growth into the middle ear, cholesteatoma, hearing loss, damage to the stria vascularis, adhesion formation, and mucosal inflammation.

Nevertheless, few reports in human subjects subsequently confirmed these effects, perhaps owing to greater thickness of the human round window membrane, especially in the setting of inflammation. As of the 1990s, combination preparations were still the most commonly used, although some physicians continued off-label use of ophthalmic aminoglycoside medications. However, a 2004 consensus panel of the American Academy of Otolaryngology – Head and Neck Surgery concluded that “when possible, topical antibiotic preparations free of potential ototoxicity should be used in preference to ototopical preparations that have the potential for otologic injury if the middle ear or mastoid are open,” and that “if used, potentially ototoxic antibiotic preparation should be used only in infected ears.”

During the past decade, ototopical preparations containing fluoroquinolone antibiotics have appeared on the market. Ofloxacin was the first such ototopical available. Ciprofloxacin, which had been used off-label in ophthalmic form for several years, later became available for otic use in a combination preparation with hydrocortisone and is now available in combination with dexamethasone. Only ciprofloxacin is available with steroid medication, which often is required to control granulation tissue involving the tympanic membrane and middle ear. Steroids also seem to improve the efficacy of ciprofloxacin in the treatment of acute otitis media and otorrhea through tympanostomy tubes. In studies of possible inner ear effects of these medications, neither ciprofloxacin nor ofloxacin has demonstrated ototoxic potential.

Both preparations are dosed twice per day, compared with three times per day for the neomycin–polymyxin B–hydrocortisone combination. However, both are also more costly and may be difficult to find on the formularies of some third-party payors.

Sensitivity studies of aural pathogens treated topically must be interpreted with caution, as traditional susceptibility breakpoints are established only for systemically administered medications. In studies of acute tympanostomy tube otorrhea, ototopic agents demonstrated equal or greater clinical efficacy, superi-
or eradication of pathogens, and fewer adverse effects when compared with oral antimicrobials. However, although both ofloxacin and ciprofloxacin–dexamethasone have FDA approval for use in infections by “otitis media” organisms, ciprofloxacin has demonstrated efficacy superior or equal to that of ofloxacin among isolates from patients with chronic otitis and sinusitis, as well as among isolates of S. pneumoniae, H. influenzae, and M. catarrhalis from all sources. An in vivo study of ototopical therapy in patients with acute otitis media through tympanostomy tubes also found ciprofloxacin–dexamethasone more effective than ofloxacin.

Aural isolates of P. aeruginosa have demonstrated little resistance to antibiotics in common ototopical preparations. In vitro susceptibility rates for polymyxin B, gentamicin, colistin, norfloxacin, ciprofloxacin, and ofloxacin in most studies are greater than 95%, although one study found 13% resistance to ofloxacin. Both ofloxacin and ciprofloxacin have demonstrated high efficacy in vitro and in vivo in the management of ototrauma due to P. aeruginosa and S. aureus.

However, recent literature suggests the emergence of strains of P. aeruginosa that are resistant to the fluoroquinolones, as well as an increasing prevalence of methicillin-resistant S. aureus, which also may be fluoroquinolone-resistant. Neo-mycin and chloramphenicol demonstrate poor efficacy, with susceptibility rates of just 17.8% and 13.4%, respectively.

Cases in which fungal elements are seen or yeast or fungus are identified by culture may be treated with topical antifungal agents such as clotrimazole dematologic solution. Such therapy may be administered in alternating doses with a topical antibiotic if a mixed infection is present. Granulation tissue is a common cause of drainage from the ear and may be found in about 15% of ears with tympanostomy tube ototrauma. Otophylactic antibiotics combined with steroids are more effective at clearing granulation tissue than are ototopical antibiotics alone. A 7-day to 14-day course of medication is recommended; however, the ear should be reassessed for residual granulation after therapy. If tissue persists, additional medication may be useful. Alternatively, the otolaryngologist may be able to salvage the tube by removing the granulation polyp in the office setting. When all other measures have failed, the tube should be removed or replaced. Steroid-containing ototopicals are also useful in the treatment of dermatologic conditions of the ear canal such as eczema; in such cases, solutions containing steroid only (ie, fluocinonide) also should be considered.

**Systemic Antibiotic Therapy**

Systemic therapy is rarely necessary to treat ototrauma; most cases can be adequately treated with debridement and topical therapy alone. In patients with severe cellulitis possibly due to gram-positive organisms, and in those cases associated with upper respiratory infection of long duration in which bacterial etiology is likely, additional systemic therapy may be considered and should be directed by cultures of the ear canal. Patients with refractory chronic suppurative otitis of more than 6 weeks’ duration are also candidates for outpatient or inpatient parenteral therapy combined with daily aural toilet.

Pediatricians are quite familiar with the oral and intravenous antimicrobials indicated when otitis media organisms are identified. (See the article by Dr. Rosenfeld on page 833). In studies investigating sensitivities of P. aeruginosa to common intravenous agents, ceftazidime, pipercillin, and tobramycin had the best susceptibility profiles for Pseudomonas; ticarcillin and gentamicin also were effective.

Aural isolates of S. aureus are exquisitely sensitive to ciprofloxacin, ofloxacin, and trimethoprim–sulfamethoxazole, less so to gentamicin and chloramphenicol, and resistant to polymyxin B. When culture results are not available, agents such as azlocillin, mezlocillin and ticarcillin/ sulbactam provide good coverage for both middle ear and external ear pathogens. Systemic use of ciprofloxacin may be considered for older children but at this time remains unapproved for young children due to the theoretical risk of bone or cartilage toxicity.

Intravenous azlocillin, mezlocillin, and ticarcillin–clavulanic acid have demonstrated efficacy in the treatment of chronic suppurative otitis. Some investigators have recommended continued oral antibiotics as prophylaxis following intravenous therapy; however, Fliss et al. found no statistically significant difference in recurrence rate with the use of amoxicillin prophylaxis.

**Follow-up for Draining Ears**

Once the ototrauma has cleared, examination of the ear canal and tympanic membrane should be completed. Retained tympanostomy tubes and eardrum perforations occasionally develop granulation tissue peripherally or in the lumen that responds to topically administered steroid-containing preparations if one was not chosen as initial therapy. Tubes also may become occluded with inspissated debris and may require disimpaction manually or with hydrogen peroxide drops. When no tube or perforation is appreciated and the history does not suggest otitis externa, the pediatrician should examine the eardrum carefully for retraction pockets or squamous debris suggestive of
cholesteatoma. Timely otolaryngologic referral should be made when otorrhea is refractory to therapy or an etiology cannot be established.

**SUMMARY**

There are a variety of causes of otorrhea in children. The most important factor in reaching the proper diagnosis and providing relief of the problem is aurial toilet. Once adequate debridement has been performed, the diagnosis is usually clearer, and treatment with ototopicals is significantly more effective.

Most cases of otorrhea are due to infection or granulation tissue and can be managed initially with appropriately selected ototopical medication, thereby avoiding the risks and side effects of systemic therapy and the need for referral to a specialist. However, otorrhea in children that is refractory to medical therapy may be due to retained tympanostomy tubes or insidious pathology such as cholesteatoma or malignancy. In such cases, prompt referral to the otolaryngologist can facilitate accurate diagnosis and successful management.

**REFERENCES**
