Medical therapy of otitis externa and otitis media

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The medical approach to therapy of otitis externa and media may currently be best described as an art rather than a science. Although the veterinary literature evaluating diagnostic techniques for otitis has grown considerably in the past few years, veterinary studies documenting medical therapies (beyond ototoxicity research) are quite scarce. Review articles [1–3] and discussions of medical approaches within the published proceedings of continuing education meetings are not uncommon, because medical therapy of otitis is a popular topic among veterinary practitioners. Information based on prospective studies that adhere to the principles of evidence-based medicine is definitely rare, however. This is not the case in human medicine.

The potential predisposing factors and direct/indirect causes of otic inflammation or otic immunosuppression are discussed elsewhere in this issue. Bacterial and fungal (yeast) infections of the ear canals are thought to be secondary problems in most cases [1]. Although veterinarians universally agree that it is of utmost importance to resolve the primary otic disease, this article focuses solely on medical therapy for the infectious component of otitis externa and media.

Because dermatologists deal with otic infections on a daily basis, this group of specialists has contributed much to the anecdotal knowledge base on the subject. Multiple approaches are routinely discussed, which often vary in the empiric choices of topical drugs and cleansers employed, the frequency and technique of ear canal lavage (both in-office and as administered by the pet owner at home), and the types and frequencies of prophylactic therapies recommended after resolution of chronic infections. One point of agreement (and much concern) is the growing evidence for
multidrug-resistant strains of *Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus* spp [4–9].

Active ingredients available for otic therapy in the acute and chronic/recurrent case of bacterial or yeast otitis are discussed here, along with the potential topical cutaneous reactions and ototoxicities that may be associated with them. Special considerations for treatment of attendant otitis media/interna and resistant bacterial strains are also presented.

**Topical versus systemic therapeutics: an overview**

Topical therapy is key to the successful resolution of otitis externa, which is essentially a surface infection. Unless the ear canal epithelium has been eroded or ulcerated extensively, systemic (oral) antimicrobials are unlikely to achieve therapeutic concentrations within the fluid and waxy exudates of the external canals in which the infectious organisms are harbored. Penetrating this “vat” of infection is best accomplished by the application of sufficient volumes of a topical antimicrobial. The choice of active ingredients for treatment of otitis externa is usually made empirically, based on cytologic examination of ear canal exudates and otoscopic examination of the inflamed canals. In contrast, the middle ear (tympanic bulla) contains a highly vascular mucous membrane lining, which may allow for better diffusion of drugs from the vascular compartment to the bulla space. The choice of systemic antibiotics for treating the middle ear compartment is preferably based on culture and susceptibility testing.

Information gleaned from culture and susceptibility testing reflects the serum level of drug required to kill the organism in question and may not be relevant in choosing topical antimicrobial preparations. Susceptibilities are typically expressed as minimum inhibitory concentrations (MICs) or reported simply as “susceptible,” “intermediate,” or “resistant” based on the Kirby-Bauer disk diffusion method. For several reasons, this in vitro information may relate poorly to the choice of topical antimicrobial. As already mentioned, adequate levels of drug (which reach the MIC for the organism) may not be achieved at the surface of the external ear canal epithelium. In addition, the concentrations of specific antimicrobial ingredients in topical preparations often greatly exceed those that could be safely achieved in the systemic circulation. For example, an organism that is reported to be resistant to gentamicin on a culture/susceptibility test may not be resistant to the high concentration of gentamicin that can be safely delivered locally within the ear canal itself. Finally, not all active ingredients used topically are represented on standard culture/susceptibility profiles. Therefore, veterinarians should be comfortable with basing an empiric choice of topical antimicrobial on the cytologic identification of the organism (or class of organism) and otoscopic evaluation of the extent of ear canal inflammation and chronic changes. The reader is referred to the
Ingredients of topical antibacterials

Most commercially produced topical products contain one or more active ingredients (antibacterial, antifungal, and anti-inflammatory) in various combinations as well as a vehicle and various solubilizers, stabilizers, and surfactants [10]. The formulation of the topical product with regard to the vehicle may be as important as the active ingredient to the success of therapy. Vehicles are chosen to maximize drug solubility, to maintain drug activity locally for the maximum period, and to minimize systemic absorption. The most commonly used vehicles are water (which may be buffered and pH-adjusted to maximize drug activity), demulcents, and emollients [10]. Demulcents are compounds of high molecular weight capable of forming stable emulsions or suspensions of drugs that are not water soluble. They coat and protect underlying tissue. Polyhydroxy demulcents, which are the most hydrophilic yet potentially irritating compounds within this class, are also the most commonly used carriers used in otic products. They include polyethylene glycol, propylene glycol, and glycerin [10]. The former two are commonly implicated in contact/irritant reactions in the author’s practice. Emollients are occlusive agents used as carriers for water-insoluble drugs and are protective and hydrating to the stratum corneum. Examples include vegetable oils, animal fats (eg, lanolin), and hydrocarbons (eg, petrolatum, mineral oil, paraffin) [10]. For a more complete discussion of vehicles and excipients than can be presented here, the reader is referred to the excellent article on otopharmacology by Wilcke [10].

Active ingredients are generally classified as antibacterials, antifungals, and anti-inflammatories. Each is discussed in more detail.

Antibacterials

Chloramphenicol

A “first-line” topical antibacterial with low potency yet broad-spectrum activity, chloramphenicol is no longer available as a commercially produced topical product. Chloramphenicol is considered to be a bacteristatic agent (except at high concentrations) against susceptible bacterial strains. Known to be associated with aplastic anemia in human beings, concern over potential drug exposure to the pet owner limited its topical use by many veterinarians when a topical product was available.

Fusidic acid

This is a narrow-spectrum bacteriostatic antimicrobial that inhibits bacterial protein synthesis by a unique mechanism. Its spectrum is limited
to gram-positive cocci; gram-negative bacilli are inherently resistant because of their impermeable cell membranes [11]. The usual clinical indication is otitis caused by staphylococcal species. Fusidic acid preparations are unavailable in the United States, but otic preparations are used in Europe and Canada.

Aminoglycosides

The aminoglycoside antibiotics are the most commonly used class of topical otic products. They act on susceptible bacteria by binding to the 30s ribosomal subunit in the bacterial nucleus, thereby inhibiting protein synthesis, and are considered to be bactericidal. Their antibacterial spectra vary by individual drug potency but include some aerobic gram-positive bacteria and many aerobic gram-negative species. They are ineffective for anaerobes and fungi [12]. Their antimicrobial activity is enhanced in an alkaline environment, which is germane to topical therapy of the ear canal. If acidifying cleansers are used in conjunction with aminoglycosides, the products should be applied at least 1 hour apart. Also of noted importance is the ototoxic potential of aminoglycosides, especially when administered parenterally. Auditory symptoms are more common with neomycin and amikacin, whereas vestibular symptoms are most typical of gentamicin, especially in the cat [12]. The ototoxic potential of this class of drugs when topically applied may be overestimated [13].

Neomycin

Often considered to be a first-line topical antibacterial [1], neomycin has the lowest potency of the class, showing significantly less efficacy against several gram-negative organisms; most notably Escherichia coli and P aeruginosa. Its activity against gram-positive cocci remains quite good. Manufactured topical products containing neomycin are plentiful and are recommended for acute bacterial otitis in which cocci predominate cytologically. Neomycin is one of the most commonly implicated topical agents for contact/irritant reactions in dogs, however (Fig. 1).

Gentamicin

Considered to be a “second-line” antibacterial, gentamicin has intermediate potency within the class. Its activity against gram-positive cocci is excellent; however, resistant strains of E coli and P aeruginosa are not uncommon. Manufactured topical products containing gentamicin are plentiful and are recommended for chronic/recurrent otitis when clinical evidence of neomycin-resistant rods is available. In general practice, these products are often used as first-line antibiotics. Despite continuing anecdotal concern over the ototoxic potential of topical gentamicin, a study in dogs designed to simulate clinical exposure via a ruptured tympanum failed to document any toxicity [14]. In human medicine, however, the risk
of topical gentamicin ototoxicity in clinical practice is now thought to have been underestimated in the past [15].

Amikacin

Considered by the author to be a third-line antibacterial, amikacin is most commonly indicated for chronic/recurrent otitis caused by gentamicin-resistant gram-negative bacilli (especially *P aeruginosa*). Amikacin is not available as a commercially produced topical product, but the injectable product (Amiglyde) is often diluted to a concentration of 30 to 50 mg/mL (in sterile saline or a tromethamine–ethylenediamine-tetraacetate [Tris-EDTA] product) by veterinarians for topical use.

Tobramycin

Also a third-line antibacterial, indications for use of tobramycin are similar to those for amikacin. Although an otic topical product is not available, ophthalmic formulations are. Dilution of injectable tobramycin (Nebcin) with sterile saline to a concentration of 8 mg/mL has been used by the author, but the long-term stability (>1 week) of the solution is unknown and remains a concern.

Fluoroquinolones

This class of antibiotics acts by inhibiting bacterial DNA-gyrase, which prevents DNA supercoiling and synthesis and is thus bactericidal. Bactericidal activity is dependent on concentration, and bacterial resistance is known to occur by rapid mutation, especially in the presence of subtherapeutic concentrations [16]. Fluoroquinolones have good activity...
against a wide range of gram-negative bacilli and gram-positive cocci (including staphylococci, although activity is variable for streptococci) [12]. Their use as second- or third-line antibiotics for chronic/recurrent bacterial otitis, especially cases associated with *P. aeruginosa*, has become common. Studies comparing two human-labeled topical fluoroquinolone products (ciprofloxacin [Cipro HC otic solution] and ofloxacin [Floxin otic solution]) with polymyxin B (Cortisporin otic) have shown the fluoroquinolones to be safe, with less ototoxic potential [17].

**Enrofloxacin**

This drug has long been used for resistant *Pseudomonas* otitis. Although a commercially produced veterinary-labeled topical product is now available (Baytril otic), veterinarians have used enrofloxacin topically for many years by diluting the injectable product for otic use. Reports of resistant strains of *P. aeruginosa* have become common [4,5,9,18], with up to 87.5% of strains being nonsusceptible in vitro [5].

**Ciprofloxacin**

With a spectrum of activity similar to that of enrofloxacin (ciprofloxacin is an active metabolite of enrofloxacin), there may be little indication for choosing this drug over the former now that a veterinary-labeled topical formulation of enrofloxacin is available. Although resistance of *P. aeruginosa* to ciprofloxacin has been reported to be less common than to enrofloxacin, there are also several laboratory-dependent explanations for the discrepancy that may prove it technical rather than clinical [19]. Regardless, a human-labeled ciprofloxacin otic product (Cipro HC) is available and has been used successfully in dogs by many veterinary dermatologists.

**Marbofloxacin**

This fluoroquinolone may exhibit a better MIC for *Pseudomonas* spp than enro/cipro [18]. Although unavailable in the United States as a topical product, it is now available in Europe in an otic formulation (Aurizon). Because an injectable product is also unavailable in the United States, topical use has been limited; however, its systemic (oral) use in otitis media/interna is increasing [20,21].

**Carboxypenicillins**

This class includes the expanded-spectrum penicillins, which exhibit activity against gram-negative organisms (including *Pseudomonas* spp) because of their ability to penetrate the gram-negative cell membrane. Ticarcillin is the carboxycillin for which topical use has been most commonly reported in the treatment of canine *Pseudomonas* otitis [22,23]. One pair of authors recommends dilution of the 6-g bottle with 12 mL of
sterile water and the addition of reconstituted ticarcillin, 2 mL, to 40 mL of an acidifying ear cleanser (with the remainder frozen for future use). The stability of this solution is unknown but may not exceed 3 days [22].

**Polymyxins**

Polymyxin B and colistin sulfate (polymyxin E) are polypeptide antibiotics that exert bactericidal effect by increasing permeability of the bacterial cell membrane via chelation of membrane phospholipid components, leading to osmotic damage. The ototoxic potential of polymyxin B has been well described experimentally in several species of animals, both in vivo and in vitro [17,24–27]. There is speculation that the ototoxicity of these products could be more specifically attributable to the propylene glycol vehicle, however [26]. One positive aspect of topical polymyxin B is its reduction of the inflammation induced by endotoxin components of gram-negative bacterial cell walls [28]. The relevance of these findings to dogs and cats is unknown. Currently, there is no polymyxin B product marketed specifically for otic use. Ophthalmic products are available (Polytrim ophthalmic solution), but the author prefers to use a more cost-effective formulation intended for dilution and use as an irrigating solution (Neosporin GU). This product comes in 1-mL ampules containing 200,000 U of polymyxin B sulfate and 40 mg of neomycin base, and it may be diluted with sterile water to 10,000 U/mL for otic use. Colistin sulfate is still available under a proprietary human label (Cortisporin-TC otic suspension).

**Silver sulfadiazine**

Used for more than three decades in human medicine as a burn wound protectant, silver sulfadiazine (SSD) has broad-spectrum antibacterial activity (most notably against *P. aeruginosa*) [29] and does not interfere with re-epithelialization and neovascularization of wounds [30]. In fact, it may enhance wound healing [31]. The spectrum of activity includes most pathogens associated with otitis (including methicillin-resistant staphylococci) [32], with the exception of *Malassezia pachydermatis*, against which activity is low [33]. Resistant strains of *P. aeruginosa* have been reported [34] but are extremely rare in the author’s practice. Silver exerts its antibacterial effect via impairment of DNA replication and bacterial cell wall damage, leading to osmotic changes [29]. Supplied as a 1% cream (Silvadene) and as a micronized powder (Spectrum pharmacy products; available at: www.spectrumRx.com), concentrations as low as 0.02% have shown 100% efficacy against *P. aeruginosa* and *Staphylococcus* spp [32]. Although the cream is not readily miscible in water, a homogeneous emulsion can be achieved with gentle mixing. The author prefers to use the powder as a suspension in sterile water at 0.5% to 1.0%. A proprietary
product that combines 1% SSD with 0.5% enrofloxacin (Baytril otic) is now available. SSD has become the favored topical therapy for *Pseudomonas* otitis in the author’s group practice, especially when the external ear canals are ulcerated. Our clinical impression is that re-epithelialization is hastened.

The ototoxic potential of SSD is unknown, although the collective experience of a large group of veterinary dermatologists suggests that it is safe for use even in the context of a ruptured tympanum. Because it is known that significant amounts of silver can be absorbed from burn wounds of human beings [35] and silver has the potential to produce systemic toxicity [36,37], caution may be warranted in veterinary patients with extensive ulceration. Evidence implicating SSD in systemic toxicity of dogs or cats has not been reported to the knowledge of the author, and a 1% suspension has been used in scores of dogs and several cats for more than 3 months without incident at the University of Pennsylvania.

*Tromethamine–ethylenediamine-tetraacetate*

This is commonly used as either a presoak or a carrier vehicle (for aminoglycoside antibiotics) in the treatment of gram-negative infections. EDTA promotes increased permeability to extracellular solutes and increased sensitization to antibiotics, whereas Tris serves as a buffer [38]. Two proprietary products are now available in the United States: TRIZ-EDTA and a similar chemical combination of Tris and tetrasodium edetate (T8 solution).

**Antifungals**

*Nystatin*

A polyene antifungal, nystatin binds to sterols in the fungal cell membrane, thereby altering permeability and mediating cell death by osmotic destruction [12]. Nystatin is primarily used to treat infections by *Candida* spp, but it also exhibits activity against *M. pachydermatitis* clinically. Nystatin is considered a first-line anti-*Malassezia* drug by at least one author [1]. In an in vitro study, neomycin exhibited only partial inhibition of *M. pachydermatitis* growth on Sabouraud’s agar [39]. Because most preparations containing nystatin are occlusive ointments, this author typically avoids using them in cases of exudative or ceruminous otitis externa.

*Azole antifungals*

Benzimidazoles (eg, thiabendazole), imidazoles (eg, clotrimazole, miconazole, ketoconazole), and triazoles (eg, itraconazole, fluconazole) all share
a common mode of action against fungi: disruption of cell wall ergosterol biosynthesis via P450 enzyme inhibition [12]. An in vitro study comparing the efficacy of the azoles against Malassezia spp yeast indicated that thiabendazole is the least effective, followed by clotrimazole (with efficacy comparable to nystatin), miconazole (with 10 times the potency of nystatin), ketoconazole, and itraconazole, respectively [40]. A more recent in vitro study showed equal efficacy of ketoconazole, itraconazole, and terbinafine against M pachydermatis [41], whereas a Hungarian study suggested that ketoconazole is the most effective, followed by clotrimazole, miconazole, and nystatin, respectively [42]. Regional variation in strain susceptibility may therefore exist.

Veterinary topical preparations of thiabendazole, clotrimazole, and miconazole are commonly employed for the treatment of Malassezia otitis in dogs and cats. Ketoconazole (Nizoral) is available only under human labels as oral tablets and a topical cream. Both may be used to formulate 1% to 2% solutions for otic treatment of veterinary patients when other more available azoles are failing clinically. A human-labeled 1% oral itraconazole elixir (Sporanox Oral Solution) has also been used topically by the author. Although sticky (in a syrup base), the product has been effective. Miconazole is the topical agent most commonly employed against Malassezia otitis in the author’s group practice, whereas clinical resistance to clotrimazole has been noted on numerous occasions. Topical azole antifungals are said to be uniformly nontoxic to the inner ear [43]. Although antifungal ototoxicity does not seem to be clinically problematic in dogs and cats, contact/irritant reactions may be noted with any of the azoles. It is difficult to exclude the role of vehicle versus the azole drug in many cases, however. Oral ketoconazole or itraconazole may be used for canine otitis media associated with Malassezia spp, whereas itraconazole is generally preferred for this purpose in cats [44,45].

**Allylamines**

This class of antimycotic agents exerts a cell-wall effect by disruption of ergosterol biosynthesis via inhibition of squalene epoxidase. Because the effect does not involve P450 enzymes, this class of antifungal drugs is generally considered to be safer for mammalian use than theazole antifungals [46]. Terbinafine has been shown to have excellent in vitro efficacy for many species of Malassezia, including M pachydermatis [41]. Although not marketed as a topical product under a veterinary label, a 1% human-labeled solution (Lamisil) is available over the counter in various preparations for the treatment of tinea. Its use for Malassezia otitis in animals has not been reported, although the author has used it successfully in a single canine patient. Oral use of terbinafine for feline dermatophytosis has been reported, and adverse effects were not noted [47], suggesting its potential utility for Malassezia otitis media in cats.
Anti-inflammatory agents

Almost every case of otitis deserves the benefits of topical corticosteroids because of their anti-inflammatory, antiproliferative, antipruritic, and antiexudative (glandular secretory) effects. Systemic steroids [preferably prednisolone or methylprednisolone orally] are also highly efficacious in reducing acute stenosis caused by edema as well as more chronic stenosis caused by proliferative hyperplasia and fibrosis.

Topical steroids are present in a large proportion of commercially prepared otic products, and their potency may depend not only on the drug’s inherent anti-inflammatory quotient but on the drug concentration and vehicle used in the product. In general, the potency of topical steroids is assumed to concur with their biologic activities. Relative potencies compared with hydrocortisone are: hydrocortisone (1), prednisolone (5), triamcinolone (5), isoﬂupredone (14), dexamethasone (25), betamethasone (25), and ﬂuocinolone (100)[10]. Some authors believe that nothing more potent than hydrocortisone should be used in cases of ulcerative Pseudomonas otitis [48]. The reader is referred to the excellent article by Logas [48] for more complete information regarding the indications and uses of topical steroids. Side effects related to topical steroids include systemic absorption with suppression of the hypothalamic-pituitary-adrenal axis (which likely increases with the higher potency steroids) [49] and topical contact reactions. Although well described in human beings [50], contact allergy to topical corticosteroids has not received attention in veterinary medicine.

The only nonsteroidal agent available in a topical otic preparation is dimethyl sulfoxide (DMSO). In addition to its significant anti-inflammatory activity, DMSO may reduce fibroplasia [51]. A 60% DMSO solution with 0.01% fluocinolone (Synotic) is quite useful for severe inflammatory and hyperplastic otitis but should be used with caution in the face of infection.

Therapy of acute otitis externa

In general a first-line antimicrobial should be chosen based on cytologic and otoscopic findings. Twice-daily therapy for a minimum of 7 to 14 days depending on the degree of inflammatory changes (edema, hyperplasia, and erosion/ulceration) combined with at-home cleansing is the author’s prescribed regimen. Of utmost importance is delivering a sufficient volume of topical agent to the canal. For example, large-breed dogs (eg, retrievers, shepherds) should receive a minimum of 10 to 12 drops (or 1 mL) per application. Re-evaluation at the end of the regimen to evaluate the cytologic and otoscopic status of the ears is recommended but not mandatory for success in most cases.
Therapy of chronic/recurrent otitis externa

A complete history, physical examination, and otoscopic examinations to search for predisposing, primary, and perpetuating factors are indicated. The status of the tympanic membranes should be confirmed. If edema or proliferative changes preclude visualization of the entire canal to the level of the tympanum, topical therapy should be initiated based on cytologic findings, and the patient should be discharged on an anti-inflammatory regimen or oral prednisolone (0.5 mg/kg every 12 hours tapered weekly to every 24 hours and then every 48 hours) and scheduled for a follow-up visit in 2 to 4 weeks for recheck. Treatment with second-line or third-line antimicrobials may be indicated depending on the history of prior therapies. The client should be prepared for longer term topical therapy (at least 4 weeks in duration). In extremely chronic cases, several months of rigorous topical therapy may be necessary to return the external canals to their normal state. Systemic antibiotics may be indicated if there is extensive tissue swelling (potentially indicating deeper infection), ulceration, or significant periaural dermatitis [1]. Rechecks should be scheduled every 2 to 4 weeks for cytologic and otoscopic examination until complete resolution is achieved.

Therapy of otitis media

Because otitis media is typically the result of extension of chronic otitis externa through a ruptured tympanic membrane, all the principles discussed for chronic/recurrent otitis externa apply here. In addition, a thorough lavage of the bulla to remove infective and inflammatory exudates gives medical therapy a good head start. In the case of bulla impaction with inflammatory exudates and debris, medical failure is virtually guaranteed without a thorough lavage.

The choice of antimicrobial agents becomes more complicated when otitis media is involved. This author prefers to avoid the topical use of fluoroquinolones completely unless a systemic form of the same drug is used concurrently because of the potential for subtherapeutic concentrations of the topical drug to reach the middle ear via the ruptured tympanum. Development of fluoroquinolone resistance is documented to occur in vitro with a single exposure to the drug [16].

Many veterinary dermatologists recommend starting an oral fluoroquinolone pending culture/susceptibility results. Systemic antimicrobial therapy based on culture/susceptibility testing of samples retrieved from the middle ear is indicated whenever possible. In fact, it has been stated that otitis media cannot be resolved with topical therapy alone [2]. Many chronic cases of otitis media involve P. aeruginosa, however, and an oral drug is not always available because of broad-spectrum resistance.

Several systemic antipseudomonal drugs intended for intravenous use can also be used subcutaneously, allowing therapy by the client at home.
Examples include meropenem (Merrem; 8 mg/kg every 12 hours) [52], ticarcillin (Ticar; 40–80 mg/kg every 6 hours) [53], and ceftazidime (Fortaz; 30 mg/kg every 4 hours) [54]. The downfall of these systemic injectable drugs is their extremely high cost. In cases of *Pseudomonas* otitis media in which an oral antibiotic is unavailable and the cost of subcutaneous therapy is prohibitive to the client, the clinicians in the author’s group practice have shown success with thorough bulla lavage followed by high-throughput topical therapy. The later entails application of large volumes (1–2 mL) of topical drug (most often, an SSD solution) twice daily and regular (daily or every other day) at-home flushing of the canals using an acidifying cleanser. It is our contention that high-volume application of low-viscosity antimicrobial preparations and cleansers promotes a continued “flushing” of the bullae as long as the tympani remain open.

Methicillin-resistant *Staphylococcus* spp also present a dilemma in selecting a systemic antibiotic. Methicillin resistance (indicated by resistance to oxacillin in most susceptibility profiles) confers resistance to all β-lactam antibiotics, and many of these strains also show broad fluoroquinolone resistance patterns. Fortunately, most strains isolated from patients presenting to the dermatology service at the University of Pennsylvania have been susceptible to chloramphenicol or macrolide antibiotics (erythromycin, azithromycin [Zithromax], and clarithromycin [Biaxin]).

Regardless, the successful therapy of bacterial or fungal otitis media relies on an initial thorough cleansing of the bulla, aggressive targeted antimicrobial therapy for an absolute minimum of 6 to 8 weeks, and consistent cleansing/flushing of the external canal by the client at home. Therapy can only be discontinued when the ear canals are negative for microorganisms on cytologic examination, the external canals have no residual edema, and the epithelium has normalized. In some cases, the tympanic membrane may not regenerate, although most do. In cases in which these criteria cannot be achieved, a prophylaxis program that incorporates regular use of cleansers and drying agents must be instituted. The level of commitment on the part of the client cannot be overly stressed. In the author’s group practice, the mean time to resolution of chronic otitis media in 44 dogs was 117 ± 86.7 days (range: 30–360 days) [20].

References


