OTOLOGY "PEARLS" – PARTS I and II

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GENERAL MANAGEMENT OF OTITIS EXTERNA

The effective management of otitis externa in both the dog and cat is strongly guided by our understanding of the factors (primary, predisposing and perpetuating) that are involved in the etiopathogenesis of otitis. For the dog

Primary factors (those that initiate otitis) : allergies (atopy, food sensitivity), ear mites, foregin bodies, factors that produce ceruminous otitis (hypothyroidism, primary idiopathic seborrhea), autoimmune diseases (e.g. pemphigus), zinc responsive dermatosis, sebaceous adenitis, ceruminous cysts, neoplasia

Predisposing factors (make the ear more likely to manifest signs; amplify signs) : anatomy (floppy ear; hair in canals; stenotic canals as in brachycephalic breeds), moisture, immunocompromising disease.

Perpetuating factors (usually secondary factors; keep the inflammation happening, even if the primary factor is gone): Malassezia, bacteria, proliferative changes, debris, overtreatment, undertreatment, otitis media, reactions to medications.

What then are the most common disease syndromes that we are called upon to treat? In the dog, by far the most common would be allergic otitis externa (atopy and/or food sensitivity) , commonly complicated by secondary Malassezia, bacteria or both. In cats, the most common primary factors are ear mites, followed by allergies (atopy and/or food sensitivity), foreign bodies, aural polyps and tumors or cerumionus cysts. In cats, all of these problems may also be complicated by secondary Malassezia and/or bacteria.

Our general principles of otitis externa therapy includes reducing/resolving inflammation, resolving secondary infections, removing excessive waxy debris and, where possible, treating the "primary factor" that initiated the problem. These endpoints are accomplished by cleansing/drying the ear and topical therapy. 85% of the cases of otitis seen in clinical practice can be managed with topical therapy alone. The rest may also require systemic treatment.

OTOSCOPY AND VIDEO OTOSCOPY

The performance of an otoscopic examination is a mandatory part of the work-up for every case of otitis. For conventional otoscopes, utilizing the largest magnification and field of view optimizes the examination. For example, with Welch Allyn otoscopes: Macroview (can change focal distance) > Pneumatic head > Operating head. Emphasis must be placed on making sure the light source is bright enough to visualize to the tympanum. How to test your light source: you should not be able to look at the light if it is bright enough; anything less will compromise visualization.

Video otoscopy has "revolutionized" Veterinary Otology. It is an "amazing" diagnostic and therapeutic tool. "In examination room" client visualization of otic changes allows for greater commitment to therapy (at home therapy and rationalization for more advanced procedures such as deep ear cleanings). "In examination room" visualization is facilitated by proper restraint: i.e. the dog's muzzle is held slightly into the thoracic inlet; pinna

pulled up and out from the base of the skull. The tip of the scope cone is placed in the "intertragic incisure " (the natural groove on the caudal aspect of the entrance to the vertical canal) to begin the examination. Although the cone is generally oriented at about 45 – 60% angle from perpendicular to start, it is moved to a more horizontal position to adequately visualize to the tympanum. In cats, restraint is usually minimal (often done with the "holder" just stabilizing the body). Otoscopy is always done before cytologic examination. If debris is obscuring visualization (e.g. degree of wall inflammation or proliferation)- pass a cotton-tipped swab into canal, then re-evaluate. Lens fogging is very common and often has to do with temperature differentials (warm ear, cold scope). You can minimize this by warming the scope tip in warm water. We have constructed a small "bulb box" that the scope head sits in during the working day to keep it warm and minimize this phenomena. A small bulb sits in one end of box. The video otoscope tip is slipped in to a hole in the other end of the box. The author's routine method of defogging and cleaning the otoscope tip is to wipe it with a cotton ball liberally soaked in alcohol. It is possible that this "clearing" may have to be done several times before adequate visualization of the ear is possible. If the view is foggy upon entering the ear, do not wait for it "clear"; it usually won't. Come out of the ear, clean the tip again, then re-insert. You may have to do this 3-4 times to get a good, clear view. Commercial defoggers can also be applied to the cone tip. While they do work, they are more expensive.

Procedures that are done routinely through the "working channel" of the video otoscope include foreign body removal, deep ear cleaning, biopsies and excisional biopsies, myringotomy and laser removal of cysts, tumors and proliferative changes. Deep ear cleaning is facilitated by the use of "grabbing" forceps, ear curettes, brushes and catheters for flushing and suctioning.

WHAT WE SEE ON OTOSCOPY: THE WONDERS OF THE TYMPANIC MEMBRANE

The tympanum of the dog is made UP of the pars tensa and the pars flaccida. The tympanum sits at a 30 – 40 degree angle from perpendicular (top being closer to you than the bottom). The handle of the malleus is found within the larger pars tensa. It is a whitish, curved structure. The pars flaccida of the tympanum of the dog is a well vascularized structure that occupies the dorsal and slightly anterior aspect of the tympanum. Unlike the pars tensa, the pars flaccida will dilate with mild increases in air pressure within the middle ear. Air pressure increases are related to the functional capability of the auditory canal (Eustachian tube). This structure is responsible for allowing air in to the middle ear to equalize pressure across the tympanum. It is common to see the pars flaccida dilate in the dog. The "outpouching" is analogous to the outpouching of the throat of a frog when it is air filled. This is due to increases in middle ear air pressure. The "outpouching" may occupy 1/3 to ½ of the volume of the horizontal canal (and, at times, even more). This dilatation can be seen in otherwise normal ears. There is some suggestion that it may more commonly occur in the presence of allergic otitis (possibly one of the earliest signs of allergic otitis?). If this is indeed the case, then the reason why it dilates in allergic patients is unclear. In any case, dilatation of the pars flaccida is probably not of clinical significance (i.e. does not bother the dog).

The author has now seen several cases wherein the pars flaccida has been severely distended with air, with the "outpouching" filling the entire horizontal canal. This has been largely noted as an incidental finding. Affected dogs

have been otherwise asymptomatic (no head shaking, no apparent hearing problems). These dilatations may be misdiagnosed as ceruminous cysts. Myringotomy has resulted in prompt deflation of the pars flaccida, only to have the myringotomy site heal and the dilatation reform within a few weeks. In light of the fact that this has not bothred affected dogs, no therapy has been deemed necessary for the problem.

It is also important to note that the pars flaccida may dilate when filled with exudate/epithelial cells/wax in association with an otitis media. A further example would be the mucous that accumulates within the middle ear in Cavalier King Charles Spaniels with Primary Secretory Otitis Media. In cases of chronic otitis media, the pars flaccida may dilate with fluid and /or debris and no longer communicate with the rest of the middle ear. In these instances, the pars flaccida may dilate enough so as to entirely fill the horizontal canal. In managing such cases, both the middle ear and the dilated pars flaccida would have to be cleaned out (i.e. a hole has to be made in the pars flaccida).

CYTOLOGY

Cytology of the externa ear canal is part of the minimal data base for every patient with otitis externa. Malassezia, bacteria and inflammatory cells are usually quantified on a 0 – 4+ scale. Results are invaluable in better defining diagnoses for the otitis and therapeutic alternatives. Cytologic "tip offs" to various diagnoses and treatment alternatives:

1. Inflamed canals – but only epithelial cells, occasional Malassezia or cocci per oil immersion field – most commonly allergy. These ears are usually pruritic (aural – pedal reflex) when swabbed for cytology.
2. Neutrophils and bacteria – often mean a deeper seated infectious problem (folliculitis, furunculosis) – warrants consideration of systemic antibiotic therapy.
3. In an ear that is being treated with topicals and you start to see neutrophils where you did not see neutrophils at the initiation of therapy – possible reaction to one or more ingredients
4. Otoscopic examination shows increase in whitish, opalescent debris and cytology shows only epithelial cells – overtreating the ear; keeping it too moist; reduce frequency of medication administration (especially cleansers).

TREATMENT "PEARLS"

Ototoxicity

A number of drugs that are commonly used in topical otic cleansers and treatments have the potential to be ototoxic. They include aminogyclosides (neomycin, gentamicin, amikacin, tobramycin), polymixin B, propylene glycol and , higher concentrations of chlorhexidine. The relative incidence of ototoxicity is low in dogs; somewhat higher in cats. There may be some genetic predisposition to this problem. Ototoxicity is most commonly associated with hearing loss (cochlear toxicity). Ototoxic drugs usually reach the inner ear through a perforated tympanum and subsequently are absorbed through the "round" (cochlear) window or "oval" (vestibular window) These are two holes in the bone on the medial wall of the middle ear. The incidence with which we see perforations of the tympanum in allergic ears with secondary Malassezia and/or staphylococcal infections is low. Scenarios that are associated with a higher incidence of perforations include: severe stenosis of the horizontal

canal (accumulating debris "backs up", puts pressure on the tympanum and eventually perforates the TM); severe purulent otitis associated with Pseudomonas spp. ("rods" seen on cytologic examination; Pseudomonas may produce proteases that may perforate the tympanum) and cases where you cannot see the tympanum because of debris accumulation and there are neurologic signs of otitis media (Horners syndrome, facial paresis or paralysis, xeromycteria) and/or otitis interna (head tilt, nystagmus, ataxia, hearling loss). In these cases, "safer" otic formulations should be used.

Safer cleansers: e.g. Mal-A-Ket plus (Dechra), Duoxo Micellar solution (Sogeval), Epi-Otic Advanced (Virbac).

Safer antimicrobial products:

1. For bacteria: injectable enrofloxacin (22.7mg/ml): dexamethasone sodium phosphate (4mg/ml) at a ratio of 1:2
2. For Malassezia : dexamethasone sodium phosphate (4 mg/ml) : 1% miconazole (1:1)
3. For Malassezia and bacteria: enrofloxacin : dexamethasone sodium phosphate : 1%miconazole (1:1:2)

" At home" Ear Cleaning

Accumulated ceruminous debris may directly irritate the ear; may produce a microenvironment conducive to secondary infection; may prevent medication from coming in contact with the affected areas of the ear; may inactivate ingredients (e.g. polymyxin B). Mild accumulations of debris may not require a cleanser and may be removed with the topical steroid/antibiotic/antifungal combination products commonly used in ears. Cleansers contain various ceruminolytics, drying agents, and germicidals. Products used by the author include Epi-Otic Advanced(Virbac: Salicylic acid, docusate sodium, monosaccharides); Mal-A-Ket plus TrisEDTA (Dechra; ketoconazole, chlorhexidine, trisEDTA) and Duoxo Micellar solution (Sogeval; surfactants, phytosphingosines). "At home" flushing is usually initiated on a once daily basis for moderate to severe debris accumulations or every other day for mild to moderate accumulations. The ear is filled with the "flush" and massaged in. Debris can be removed from the inner flap of the ear with the use of a cotton ball. For more severely inflamed ears, we suggest a "**NO RUSH TO THE FLUSH**" approach, wherein the ear is treated with a topical "steroid containing product" for 2-4 days before the flushing is started. This allows inflammation to subside and makes the flushing procedure better accepted by the pet and easier to do for the owner.

Topical Therapies

Products generally contain an antibiotic, glucocorticoid and antifungal. They are used to treat otitis problems complicated by secondary Malssezia, bacteria or both. Products commonly used in our practice include Otomax (Merk; gentamicin, betamethasone, clotrimazole; BID to initiate), Mometamax (Merk; gentamicin, mometasone, clotrimazole, q24 hrs); Posatex (Merk, orbifloxacin, posaconazole, mometasone, q 24 hrs), Surolan (Vetoquinol; Polymixin B, prednisolone, miconazole) and Tresaderm – (MSD AGVET; neomycin, dexamethasone, thiabendazole, propylene glycol). It is important that adequate amounts of medication be placed in the ears. The amount used is dictated by the size of ear. Small ears (cat, small dog) – 3-4 drops; medium sized dogs (Golden retriever) – 6-8 drops; large dogs (St. Bernard) 12-16 drops. The frequency of use is dictated by the product (once or twice daily). One must also remember to treat the inner aspect of the pinna, if involved.

When only Malasseiza are found cytologically , we frequently compound a mixture of 1%miconazole and dexamethasone sodium phosphate (1:1 ratio) to circumvent the use of an antibiotic when it is not necessary. This formulation is usually used twice daily to initiate therapy. This and the "formulated", "safer mixes" noted above, are placed in a multi-dose vial. This facilitates the accurate measurement of solution put in the ear. We use larger volumes of these aqueous products : small dog or cat – 0.3 – 0.4 ml; medium sized dog – 0.5 0.8 ml ; large breed dog – 0.8 – 1.2 ml. These therapies are usually initiated on a BID basis.

Long Acting Topical Therapies

Longer acting "slow release" products are becoming quite popular. After placement in the ear, they will slowly dissipate and release their ingredients over 1 -2 weeks.. BNT ointment is formulated by BCP Veterinary Pharmacy in Houston, Texas. It is lanolin based and contains enrofloxacin, ketoconazole and triamcinolone. After placement in the ear, it is slowly released over two weeks. Formulations containing Poloxamers can be used in a similar fashion. Poloxamers are liquids at refrigerator temperatures, but solidify when placed in the ear. They can be formulated to contain an antibiotic, steroid and/or anti-fungal and are available through many formulating human pharmacies. For instance, you can place the same concentrations of gentamicin, clotrimazole and betamethasone in the producet as included in Otomax (Merck). The ear is generally flushed and dried prior to installation of the polaxamer. Once placed within the ear, the polaxamer slowly dissipates over about one week, slowly releasing its active ingredients. Hearing may be decreased for the first few days after instillation, because of the "mass effect" of the medication. In humans, poloxamers are not considered ototoxic (although their ingredients may be). A Veterinary product utilizing this technology has recently been marketed (Ketocort Otic, Trilogicpharma), containing ketoconazole and hydrocortisone; designed for weekly re-application. The author has primarily used these products for difficult to treat individuals.

Systemic Antibiotics

Systemic antibiotics are considered if bacteria are seen cytologically and:

1. The otitis is severe and large numbers of neutrophils are noted on cytologic examination (suggests a deeper infection)
2. In the presence of proliferative otitis (topical medications may not be able to get to where they need to get)
3. When there is a significant peri-aural dermatitis
4. Concurrent otitis media.
5. When the owners are unable to adequately treat with topicals

Antibiotics are best chosen by culture and sensitivity testing but empiric choices include cephalexin, cefpodoxime or Clavamox when cocci are seen cytologically or marbofloxacin or enrofloxacin if rods are seen cytologically.

Systemic Anti-Malassezia Therapy

1. More refractory Malassezia infections - especially where the owners are unable to do as good a job as we would desire for topical treatment

2. Proliferative otitis – because topical therapy may not get to where it needs to get to
3. Otitis media wherein Malassezia are involved.

Anti-fungals used: oral ketoconazole (emphasis on BID therapy – e.g. 5 – 10 mg/kg BID, fluconazole or itraconazole

Systemic Glucocorticoids

Systemic glucocorticoids are an invaluable adjunctive therapy used to quickly reduce inflammation associated with more severe otitis externa (especially if allergic in origin). They are also effective therapies for reducing proliferative changes within ears. For routine therapy, we generally start therapy with oral prednisone/prednisolone at 0.5 to 1.0 mg/kg/day (use higher range for more severe inflammatory changes). Severe proliferative changes are often started on even more aggressive dosages (1.0 to 2.0 mg/kg/day).

CLIENT EDUCATION AND FOLLOW-UP

It is very important to provide proper instructions for medication use. Consideration should be given to providing the client with instructions to take home (e.g. medication application technique, frequencies, amounts etc.).
Follow-up: the initial recheck for most cases of otitis externa is usually done two weeks after initiating therapy. Subsequent rechecks are dictated by response to therapy. Each follow-up examination should involve an otoscopic examination, cytologic examination of exudates and an accurate recording of findings. Routine rechecks should be maintained until the problem is either resolved or controlled.

DEEP EAR CLEANING

Flushing and suctioning : for rapid debris removal and also cleaning around and over the tympanum, we routinely use flushing and suction. This is done under anesthesia. We flush with a 12 cc syringe through an open ended tomcat catheter and suction through a suction apparatus attached to a 14 gage Teflon catheter (Abbott; jugular catheter). This is done through a hand held operating otoscope. The suction apparatus used should allow for suction control : i.e. more suction when working more superficially in the ear to remove large amounts of debris quickly; less suction when working deeply within the ear, especially around the tympanum. The tympanum can be perforated with excessive suction. It is always better to start with lesser amounts of suction if there is a question. The video otoscope can then be used to better visualize progress, especially deeply within the ear or to do the "finer" cleaning deeply within the ear. Fluid used for flushing – warm saline; if debris more difficult to break up, consider the use of a ceruminolytic such as Epi-Otic Advanced or for heavier, drier wax accumulations Cerumene (squalene; Vetquinol) or KlearOtic (squalene; Dechra) to soften material.

Cleaning through a video otoscope:

In the anesthetized patient, the simple infusion of saline through the video otoscope expands the canal and improves visualization, prevents fogging and frequently is associated with loosening up and "flushing out" of debris.

Video otoscopes ideally have a working channel to which you can attached a 2 channel adapter. The use of the adapter allows for simultaneous infusion of saline and the simultaneous passage of grasping forceps or the ear

curettes to facilitate debris removal. The author will also pass a "cut off" 5F polypropylene urethral catheter down the operating channel and do "directed" flushing of particularly difficult to remove debris (i.e. running fluids and flushing through the urethral catheter at the same time).

Flushing and suctioning apparatus: e.g. Vet pump II (Storz)– offers the option of flushing and suctioning through the same catheter, utilizing a "one handed" button system. The video otoscope can be held in one hand while the flushing/suctioning unit is held in the other. Alternatively, one individual to direct the video otoscope and another can do the flushing/suctioning. A 5 F urethral catheter is attached to the Vet pump and passed through the operating port of the video otoscope. The greatest cleaning action is simply achieved in the "flush" mode… running large amounts of fluid through the ear. Flushing pressures can be altered to facilitate this cleaning. The magnitude of the suctioning should be closely monitored. Excessive suction will result in collapsing of the canals.

Squalene (heavy oil in KlearOtic by Dechra; Cerumene by Vetquinol)

This heavy oil is especially effective in softening drier wax within ears. It can be injected within waxy accumulations to facilitate wax removal . This is usually done during deep ear cleanings. It is safe if it gets in to the middle ear and can actually be used to facilitate cleaning the middle ear. We usually do not sent this home with clients as an "at home" flush because of the messy nature of the heavy oil.

MEDICAL MANAGEMENT OF PROLIFERATIVE OTITIS EXTERNA (ear "salvage")

The most common underlying cause for canine chronic proliferative otitis externa is allergy (atopy and/or food sensitivity). This underlying pathology is then contributed to by secondary infections (Malassezia and/or bacterial infections) and waxy debris accumulation. With more acute allergic otitis externa there is edema and inflammatory cell infiltrate within the dermis. With chronicity, a number of pathologic changes occur that result in narrowing of the lumen of the horizontal and vertical canals. The epidermis becomes hyperplastic and is potentially thrown in to folds. The dermis widens and the lumen of ear canal narrows. This is in part due to ceruminous glands becoming dilated and fluid filled. Some ceruminous glands will rupture, producing an inflammatory response. Sebaceous glands may increase in numbers and size. Folliculitis may proceed to a furunculosis and create inflammation (follicles rupturing and releasing their products into to the dermis). Fibrosis develops . In some individuals, horizontal and/or vertical canal narrowing is produced by 360 degree canal wall thickening and/or folding. In others, proliferative nodules will be produced and will also contribute to this narrowing. With severe, chronic, deep seated inflammation, soft tissues around the auricular cartilages will calcify/ossify. Cocker spaniels tend to develop these severe proliferative changes more rapidly than other breeds. Otitis media is noted to be present in 50 – 80% of these proliferative ears. When ear canals become severely stenotic, debris accumulation (wax, epithelial debris, exudate) puts pressure on the tympanum and eventually results in tympanum rupture and debris accumulation within the middle ear.

Many of the soft tissue changes that occur with chronic, proliferative otitis are reversible. Calcification of the peri-auricular cartilage soft tissues is considered a permanent change and contributes to permanent ear canal stenosis.

Therapy

The basic tenants of "salvaging" cases of chronic, proiferative otitis externa include controlling the underlying primary factor (e.g. atopy and/or food sensitivity), improving or resolving proliferative changes, resolving secondary infections, removing debris from the ears and controlling the underlying primary factor (e.g. atopy and/or food sensitivity). Once these endpoints have been achieved, most of these individuals will require long term, maintenance management for their ears.

The management of chronic, proliferative otitis places emphasis on "opening up" the canals of the ear (i.e. widening the lumen). This will facilitate access to the deeper aspects of the canals which will in turn facilitate the delivery of topical medications to "where they need to get to" and debris removal. It will also allow for access to the middle ear (if involved), for both cleaning and medicating purposes. **A patent ear canal is considered essential to the effective medical management of all cases of chronic otitis externa.**

Systemic therapy:

1. Systemic glucocorticoid : starting at 1-2 mg/kg/day prednisolone/prednisone for two weeks, then .05 - 1 mg/kg for two weeks, then 1 mg/kg every other day for two weeks, then 1.0 - 0.5 mg/kg every other day for two weeks and gradually taper. The decision as to where in this dosage range one should start is dictated by the severity of the disease. Systemic glucocorticoid therapy is generally maintained until proliferative changes have been significantly reduced.
2. Oral cyclosporine – as a steroid alternative for reduction of proliferative changes associated with allergic disease is only variably effective. It is suggested to be most effective in cocker spaniels with proliferative disease. Concurrent steroid therapy can be used early in the course of the cyclosporine therapy, to hasten the response to treatment. We generally start with 5 mg/kg/day cyclosporine.
3. Systemic antibiotic (if bacteria present cytologically) - chosen on the basis of cytology initially – cephalexin for cocci, marbofloxacin or enrofloxacin for rods; ideally do culture and sensitivity testing and choose subsequent antibiotic therapy based on this data
4. Systemic anti-Malassezia therapy (if Malassezia present on cytology) – for dogs – ketoconazole at 5-10 mg/kg BID, fluconazole at 2.5 – 5 mg /kg q 24 hrs or itraconazole at 5 mg/kg q 24 hrs.

Topical Therapy if Tympanum is Intact

1. Topical glucocorticoid/antibiotic/antifungal preparations : if the tympanum is intact, all options are acceptable (e.g. Otomax, Mometamax, Posatex – Merck; Tresaderm - Merial), . For proliferative changes, the author tends to favor ointments over solutions for improved contact time. All products are used BID.
2. Ear flush - e.g. TrisEDTA containing product such as Mal-A-Ket Plus (Dechra) - often chosen, especially if gram negative infections suspected (i.e. "rods" seen on cytologic examination).

Topical Antibiotic and/or Anti-Malassezia Therapy if The Integrity of the Tympanum is Unknown or the tympanum is known to be perforated:

1. For bacteria : injectable enrofloxacin (22.7mg/ml): dexamethasone sodium phosphate (4mg/ml) at a ratio of 1:2

2. For *Malassezia* : dexamethasone sodium phosphate: 1% miconazole (1:1)
3. For bacteria and Malassezia: enrofloxacin:dexamethasone sodium phosphate: 1%miconazole (1:1:2).

Topical Potent Glucocorticoid – safe if tympanum not intact

Synotic (fluocinolone and DMSO) – very potent steroid (100X potency of hydrocortisone) – 3-7 drops BID to initiate. If an antibiotic effect necessary, add enrofloxacin (22.7 mg/ml) – 2:1 mix ; initiate with once or twice daily therapy.

Ear Flush if Integrity of Tympanum Unknown

1. Mal-A-Ket Plus (Dechra); trisEDTA (TrizEDTA by DermaPet Inc)
2. Douxo Micellar Solution (Sogeval)
3. dilute vinegar and water (1:2)

Deep Ear cleaning

Severely stenotic ears may be difficult to "flush" because of the degree of stenosis initially present. However, once the ear canal does "open up", emphasis is placed on removing all debris from the ear. If it is not possible to accomplish this end with "at home" or "in clinic" ear bulb cleaning, a deep ear cleaning should be performed under general anesthesia. Techniques favored by the author include "flushing" through an open ended tomcat catheter and suctioning through a 14 guage Teflon catheter attached to a suction apparatus. This process is greatly facilitated utilizing a video otoscope (flushing and suctioning, grasping debris etc.). If the tympanum is noted to be perforated, then samples should be taken from the middle ear for cytology and culture and middle ear should be thoroughly flushed and suctioned to remove debris.

Intralesional glucocorticoids

Intralesional glucocorticoids are used at the time of deep ear cleaning (when patient anesthetized) to hasten the resolution of proliferative changes and to lessen the amount of systemic glucocorticoid necessary to reduce proliferative changes. We utilize triamcinolone acetonide (2 mg/ml; note – we dilute 6 mg/ml to get this final dilution); spinal needle (3.5", 22 gauge); ear should be well cleaned; 0.1 ml injections into proliferative lesions or if 360 degree proliferation, administer in a "ring" of 3 points around wall, with each "ring" 1-2 cm apart as you come out of the ear. The maximum triamcinolone dosage that this author usually uses in a 30 – 40 pound dog is 6 mg. Repeat administration may be considered in 3-4 weeks. When intralesional therapy is used, dosages of systemic therapy are usually reduced - i.e. instead of starting at 1-2 mg/kg/day, start at 0.5 – 1 mg/kg/day of prednisone/prednisolone.

Ear "Wicks"

Ear "wicks" are polyvinyl acetate, highly absorbent sponges that can be placed in the ear (under anesthesia). They expand when hydrated. They are indicated in patients who have proliferative otitis (wherein it is difficult to get medication to where it needs to get to in the ear). Sources: 9X24 mm - JorVet AbsorbENT, J-108-4a; can also buy

colored, bacteriostatic Sinus packing (Ivotec International Expandacell) which you can trim to desired size. Ear wicks of these sizes for use in human otology are also readily available on line . As much debris as possible should be removed from the ear before wick placement. After placement in the ear, the wick is hydrated with appropriate topical solution (usually one of our "safer" aqueous mixes such as enrofloxacin:miconazole:dexamethasone - 1:2:1 or 1:2 enrofloxacin: Synotic). This solution is then placed in the ears by the owner daily to every 3 days. The wick is usually removed (and possibly re-placed) every 1-2 weeks. At times, the dog will remove the ear wick (shake it out).

Laser Therapy

It is possible to laser some proliferative lesions with either CO_2 or diode lasers. This may facilitate an increase in the diameter of the ear canal and reduce secretions.

Follow-up

It is very important that patients be rechecked every 2-4 weeks while on these more aggressive regimens to resolve infections and reduce/resolve proliferative changes. Once maximal benefit has been noted, a decision must be made regarding topical maintenance therapy (e.g. for allergic otitis – see Canine Allergic Otitis – From A to Z in these proceedings).

Factors affecting the Prognosis of Chronic Proliferative Otitis Externa

For severely stenotic ears: if, after a couple of weeks of aggressive oral and topical steroids, appreciable reduction in the stenosis of the canals is not noted, then the prognosis for the medical management of the problem is poor and consideration should be given to total ear canal ablation. This most commonly occurs in ears that are extensively calcified. If the owners are unable to medicate the ears well, then the prognosis for the successful long term medical management of the ears is poor.

TrisEDTA CONTAINING PRODUCTS – WHEN AND HOW?

Tris-EDTA has been a very beneficial addition to our armamentarium of treatments for the management of bacterial otitis, especially *Pseudomonas* otitis. Tris-EDTA has been shown to increase the susceptibility of various bacteria (*Pseudomonas aeruginosa*, *Staphylococcus aureus*, *E.coli* and P*roteus mirablis*) to several antibiotics (enrofloxacin, cephaloridine, or kanamycin). It has also been shown to potentiate the effects of chlorhexidine and silver sulfadiazine. The Tris-EDTA containing products the author uses are all marketed by Dechra: TrizEDTA (contains only TrizEDTA), TrizUltra plus ketoconazole (TrisEDTA and ketoconazole), Mal-a-Ket Plus (TrisEDTA, chlorhexidine and ketoconazole). TrisEDTA products are used in several different ways:

1. Mal-A-Ket Plus or TrizUltra + ketoconazole - to flush the ear 10 minutes prior to instilling topical antibiotic containing products (e.g. especially for suspected Pseudomonas, when the tympanum is intact - Otomax [Gentamicin], Surolan [Polymixin B], Cortisporin Otic [Polymixin B; human product, twice the concentration of Polymixin B in Surolan], Baytril Otic [enrofloxacin and silver sulfadiazine]. When the tympanum is not intact or one is not sure – enrofloxacin:Synotic (1:2) or a mix of enrofloxacin : dexamethasone sodium

phosphate (4 mg/ml) (1:2) or a mix of enrofloxacin:dexamethasone sp: 1% miconazole (1:1:2). The enrofloxacin in these mixes is 22.7 mg/ml

2. Enrofloxacin mixed with a Tris-EDTA solution: when using these products in combination, the author tries to achieve a final concentration of 10 mg/ml of enrofloxacin (i.e. 13 mls of 100 mg/ml injectable enrofloxacin per 118 ml of TrizUltra + ketoconazole - Dechra). Others have claimed similar success with concentrations of 4 - 5 mg/ml of enrofloxacin. The combination product is used BID to initiate therapy (ear is filled with the combination and massaged in). The author has used a combination of enrofloxacin and TrizEDTA (Dechra) in middle ears, without apparent ototoxicity.
3. Enrofloxacin (22.7 mg/ml) : Dexamethasone spp (4 mg/ml) : TrisEDTA + ketoconazole (TrizUltra + ketconazole – Dechra) (1:1:4). Used BID in the ear.

MANAGEMENT OF *PSEUDOMONAS* OTITIS EXTERNA

In the dog, *Pseudomonas* is most frequently seen with chronic otitis, especially when proliferative changes are noted within ears (*Pseudomonas* is well adapted to the warm, moist environment of proliferative ears). The most common primary factors producing these changes are allergies (atopy and/or food sensitivity). Breed predispositions include pendulous ears or dense hair within or around the entrance to the ear canals, both of which may reduce aeration and promote moisture retention. Other primary factors associated with secondary *Pseudomonas* infections include foreign bodies, immunocompromising diseases (e.g hypothyroidism or hyperadrenocorticism), erosive autoimmune diseases (e.g.pemphigus foliaceus) and neoplasia. Pseudomonas is noted to be associated with biofilm formation in at least 50% of cases. Biofilms may hinder the exposure of antimicrobials to the bacteria.

Therapy

1. Thorough deep ear cleaning to remove debris, bacteria and their mediators of inflammation and biofilm. Significant benefit may be associated with repeat deep ear cleanings.
2. "At home" ear flushes to facilitate debris removal and/or to take advantage of ingredients with variable antimicrobial effects:
   a. TrisEDTA containing product (chelating agent; enhances antimicrobial effect of other antibiotics and antimicrobials). Used to flush the ear 10 minutes before putting antibiotic containing product in ear
      1. Mal-A-Ket Plus (Dechra) – ketoconazole, chlorhexidine, TrisEDTA
      2. TrizUltra + ketoconazole (Dechra) – ketoconazole and TrisEDTA
   b. Acetic acid containing product (acetic acid has unique anti-pseudomonal effects):
      1. Dilute white vinegar and water (1:2)
      2. Malacetic Otic – acetic acid, boric acid (Dechra)
   c. Monosaccharides - salicylic acid, lactic acid and PCMX as EpiOtic® Advanced; monosaccharides noted to reduce *Pseudomonas* adherence to epithelial cell surfaces .
2. Topical drugs to consider as "empiric" choices for treating suspected *pseudomonas* infections:
   a. gentamicin : e.g. Otomax, Mometamax (Merck); only if tympanum is intact; potentially ototoxic)

b. Polymixin B : Surolan (.53 mg/ml or about 3,000 units/ml polymixin B; Elanco) – but may not be enough polymixin; consider Cortisoporin Otic solution – 1.6 mg/ml or 10,000 units/ml polymixin B, Glaxo Wellcome; only if tympanum is intact; ototoxic).

c. enrofloxacin (safe in middle ear) - Baytril Otic (Bayer) OR 22.7 mg injectable enrofloxacin plus saline 1:1 OR enrofloxacin plus dexamethasone sodium phosphate - 1:2 or 1:1 OR enrofloxacin plus 1% miconazole and dexamethasone sodum phosphate (1:2:1)

d. Ciprofoxacin – 0.2% (Cipro Otic, Cipro HC Otic, Ciprodex). Also ciprofloxacin ophthalmic sol. (0.3%; safe in middle ear) plus dexamethasone sodium phosphate (4 mg/ml) – 10 ml cipro plus 2 ml dex. spp.

e. Silver sulfadiazine (appears to be safe in middle ear) – 1% cream diluted 1:9 with water (only the Silvadene ® product mixes well with water; generics do not mix well) or have a solution of silver sulfadiazine powder made up (1% solution). Ear should be cleaned prior to application to enhance efficacy.

3. Topicals to consider based on culture and sensitivity testing
   a. Ticarcillin or Ticarcillin and clavulonic acid (Timentin; GlaxoSmithKline). Although the author has, for several years, used this product in middle ears and not noted any obvious ototoxicity, there has been a recent report of ticarcillin ototoxicity (hearing reductions as determined by BAER evaluations) in dogs with perforated tympana. The re-constituted product is suggested to have a shelf life of only 3 days at room temperature. It has been shown that the reconstituted product will retain its efficacy for one month at refrigeration temperatures (4 C). With this information in mind, the author now uses Timentin; 3.1 gm vial; reconstitute with 26 ml (100 mg/ml); placed in 4 ml aliquots in syringes and refrigerated. Each 4 ml aliquot is used over 2 days; .5 - .7 ml in each ear BID (for medium sized dogs); .3 - .4 for small size; .6 – 1.0 for large breed dogs).
   b. Amikacin (potentially ototoxic; only use if tympanum intact) 250 mg /ml injectable diluted to 25 mg/ml – volumes as noted above for ticarcillin
   c. Tobramycin (0.3%; human ophthalmic solution; ototoxic; only use if tympanum intact)
4. Systemic antibiotic therapy may be of benefit; potentially indicated when ears are proliferative, erosive or ulcerated and /or there is otitis media or it is difficult for the owners to treat the ears. Those antibiotics found to be more effective include marbofloxacin, ciprofloxacin, ticarcillin (60 – 75 mg/kg BID SubQ) and ceftazidime (30 – 50 mg/kg BID SubQ).
5. Topical and systemic glucocorticoids are usually of significant benefit and frequently used. They more rapidly reduce inflammation, exudation, pain, discomfort and proliferative changes. Prednisone/prednisolone, starting at 0.5 – 1.0 mg/kg/day
6. The successful management of *Pseudomona*s infections puts great emphasis on case follow-up (otoscopic and cytologic examinations + culture) to assure that the problem is put in to complete remission.

Prevention of recurrence emphasizes the need to resolve / control primary factors (e.g. allergy) and perpetuating factors (e.g. proliferative changes).