Five Things about otitis I Wish I'd Known (When I Was in Practice)
James O. Noxon, DVM; Diplomate ACVIM (Internal Medicine); Iowa State University

Introduction

The 2007 data from Veterinary Pet Insurance lists ear infections as the number ONE reason that dogs went to veterinarians in 2007 and the eighth most common reasons that cats went for veterinary care. This data is similar to the 2005 data and all other surveys done in veterinary medicine over the past 20 years. Obviously, and I may be “preaching to the choir” in this area, veterinary practitioners see a lot of patients with otitis externa.

There are many, many important concepts about otitis that can literally make the difference in practice. Knowledge can, in fact, change your entire attitude about dealing with ear disease. I know because it did for me. I used to cringe when ear problems came into the hospital…but now….. I LOVE IT. Here are a few of the things that made the difference:

#1 – Anatomy and Physiology (or Structure and Function)

I’m sure that these words send needles up and down your spine, BUT you really can’t understand how to manage a patient with ear disease until you understand what the ear is all about.

The ear consists of the pinna, the external ear canal, the middle ear, and the inner ear. There are major variations in the anatomy from breed to breed, especially with respect to the length and diameter of the external ear canal. These variations will affect predilection for disease, diagnosis, and treatment. For example, it can be very difficult to fully examine the external canal of the ear of an Irish setter, for it can be very long!

The external ear canal consists of skin overlying the auricular and annular cartilages. It has a vertical component and a horizontal component. The vertical component is formed by the auricular cartilage. The annular cartilage is the rolled, tube-like cartilage that extends from the auricular cartilage at the base of the vertical ear canal to the temporal bone. The auricular cartilage overlaps the annular cartilage with a fibrous band, which allows for flexibility in movement.

Anatomically, the vertical canal is more open and larger in volume than the horizontal ear canal. There is a depression or pocket at point where the auricular and annular cartilages overlap (i.e., the “opening” of the horizontal canal). The entrance to the horizontal canal is often elevated and requires manipulation of the otoscope in order to pass it into the horizontal canal. There is actually a fold of skin (overlying cartilage) on the dorsal aspect of the canal that must be bypassed in order to slip the otoscope into the horizontal ear canal. Mechanical irritation (e.g., during otoscopic examination) of this fold will cause startle the patient and result in poor patient compliance with otoscopy.

The skin lining the ear canal has sebaceous glands and apocrine (i.e, ceruminous) glands throughout the length. Sebaceous glands are found in the superficial part of the dermis with the apocrine glands located deeper. These apocrine glands can open directly onto the surface of the skin or in the hair follicle. Hair follicles are found throughout the length of the ear canal in most breeds, but there is breed variation as to the type of follicles and their density.

Ear wax is the mixture of apocrine (cerumin) gland secretions, sebaceous secretions, and epithelial cells. There is a natural movement of sebum outwardly in the normal ear, facilitating natural cleaning and removal of sebum. The lipid portion of ear wax is derived from sebaceous glands and contains various waxes and fatty acids, many of which are bacteriostatic and fungistatic. The lipid portion of cerumen is responsible for controlling microorganisms. The apocrine secretions (from “ceruminous glands”) produce a water-based secretion that contains phospholipids and IgA, which also contributes to the defense of the ear. Epithelial cells contribute to the texture and consistency of the wax. Increased epithelial cell production in the ear will produce a thicker, pasty ear wax.

Clinical Significance: The otoscopic examination is easier when the anatomy is
understood. The otoscope is rested in the intertragic notch (fissure) which can then be used as a fulcrum as the otoscope is advanced. This placement seems to calm the animal about the movement of the scope down the ear canal. The canal should always be visualized as the scope is passed down the canal. The clinician will hold onto the pinna to facilitate restraint and to manipulate the ear canal during the examination. As the scope reaches the ventral-most aspect of the vertical canal, the pinna is gently pulled laterally (outwardly) and down to straighten out the external ear canal. There is a ridge of cartilage located at the junction of the vertical and horizontal canals, which is often traumatized during examination. Any pressure on this ridge seems to cause discomfort to the animal and will disrupt the examination, so it is very important to pass this area as carefully. To do so, the otoscope cone should be passed along the canal as ventral as possible, and then the cone can actually be used to “lift” up the ridge of cartilage. The horizontal canal will be visible and the scope can then be slid into that area. Understanding the anatomy is also critical to facilitate proper treatment and application of medications, as will be discussed in the therapeutics session.

#2 – What does the tympanum really look like?
I’m pretty sure that I never actually saw an ear drum when I was a veterinary student. I’m pretty sure that I never really saw an ear drum when I was in veterinary practice. Sure, I saw that “white glistening thing” down in the ear canal. But I don’t think I knew what it was all about.

The tympanic membrane is at the end of the external ear canal. On otoscopic examination, the tympanum appears as a vertically aligned structure, but it actually is sloped at approximately a 30° angle, with the top towards the viewer. The tympanic membrane consists of two parts. The pars tensa is the tightly stretched, clear to opaque whitish section of the tympanic membrane. Embedded within the pars tensa is the handle (aka manubrium) of the malleus, the largest ossicle of the middle ear. The malleus is curved, with the concave section pointing rostrally. The pars flaccida is the dorsal-rostral component of the tympanic membrane. It appears pink and there are often small capillaries visible on the surface of the membrane. The pars flaccida often bulges out and may be seem moving with respiration, in a movement that resembles the bulging throat of a bullfrog!

The tympanum in the cat is much more transparent, and thus is often thought to be absent. The malleus is straighter than in the dog and the pars flaccida is generally not visible. Cats also have a bony septum in their middle ear that runs rostral to causal….and this septum

Clinical Significance: The obvious one is better job satisfaction, but in addition, you’ll now be able to understand how to perform other tests and procedures, like pneumootoscopy and myringotomy.

#3 – Pathophysiology of Otitis

The Three Ps

This is also a biggie. It is VERY important to understand why the ear does what it does in the face of inflammation. Dr. John August first introduced us to the first major point in this section (Vet Clin North Amer 1988:18;731-742.). He recommended dividing the pathogenic factors of otitis as follows:

1) predisposing factors: these are conditions that “set the ear up” for inflammation. They include conformational changes, behavior, and previous treatments.
2) primary factors: these are those conditions that initiate inflammation in the ear. They include allergic diseases, foreign bodies, ectoparasites, autoimmune and other inflammatory skin disorders, and trauma.
3) perpetuating factors: these factors keep the inflammatory process active and often make it significantly worse. Perpetuating factors include bacterial infections, yeast infections, hyperplastic changes, and otitis media.

Simply put, there is a “WHAT” and a “WHY” when dealing with ear disease. Clinicians must address both or the problem will fail to resolve or recur.
Pathologic Changes in the Ear

Once the otitis has begun, certain pathologic changes occur that initiate a cascade of events that make the ear more hospitable for microorganisms and reduce the lumen size of the ear canal. Inflammatory changes are accompanied by pain, and progressive disease leads to loss of hearing. It has been determined that the pathologic changes in the ear do reduce acuity of hearing, and that some of that hearing loss is reversible, as the pathologic changes are reversed.

With inflammation comes edema and infiltration of inflammatory cells. Secretion of various growth factors will result in epidermal hyperplasia and hyperkeratosis, resulting in microfissures on the surface of the skin and increased deposition of cornified keratinocytes in the lumen of the ear. As inflammation progresses, there is fibroplasia (i.e., fibrosis) of the dermis and subcutis. Chronic inflammation of the cartilage will result in ossification of these structures.

Within the dermis, it has been shown that apocrine glands increase in size in otitis externa. The intense inflammation around apocrine glands, combined with epidermal hyperplasia (papillary proliferation) results in occlusion of ductal openings on the skin and hair follicles and may predispose the gland to rupture. When the apocrine glands rupture, there is infiltration of lymphocytes, neutrophils, mast cells, and macrophages into surrounding tissue. It would appear that the disruption of these glands significantly contributes to the inflammation, pain, and fibrosis. Interestingly, sebaceous glands remain the same size, even in chronic otitis externa, though there is a qualitative change in sebum production. The net result is decreased lipid content of cerumen in ears with otitis externa. Since lipid secretions of the skin have barrier and antimicrobial functions, there is speculation that this change further contributes to secondary infections in otitis externa.

The environment within the external ear canal remains amazingly constant in the normal dog, despite external changes in temperature and humidity. However, once otitis externa is present the temperature in the ear canal rises. In addition, increased apocrine secretions may contribute to changes in the microenvironment by diluting the lipid content of cerumen. Therefore, these functional changes may be partially responsible for increased relative humidity and increased bacterial proliferation.

Finally, biopsy of the ear canal in chronic otitis externa will reveal folliculitis and furunculosis. With furunculosis there is release of keratinized materials into the dermis, and the net result is a foreign body-type reaction. Furunculosis is common in ceruminous otitis externa associated with familial seborrhea of the American cocker spaniel.

Clinical Significance:

Chronic uncontrolled inflammation results in progressive changes. These changes will eventually become irreversible. Treatment of otitis externa is severely hampered by the fibrosis and edema, which reduce the size of the lumen of the external ear canal. Hyperplasia of the apocrine sweat glands may lead to dilution of the cerumen, thus increasing humidity in the external ear canal and possibly altering the bacteriostatic nature of cerumen. Bacterial folliculitis and furunculosis, of the skin elsewhere on the body, dictate systemic antibacterial therapy for 3-8 weeks. Yet it is common for veterinarians to place dogs with chronic otitis externa on antibiotics for 5-7 days. These patients need long term therapy to clear the infection. Furunculosis is furunculosis, regardless of the location.
#4 – Following Principles of Therapy

(4A) – An appropriate amount of topical medication must be used, and
(4B) – Treatment must continue for an appropriate period of time

Overall, the success of topical therapy depends upon:
- The efficacy of the active ingredients
- Removal or reduction of obstructions (hair, exudate) in the ear canal
- The formulation of the medication
- The technique, frequency, and duration of administration
- The volume of medication instilled at each treatment
- The integrity of the tympanic membrane

Ear medications are most often in the form of an ointment (emulsions of lipid in water) or as a solution (aqueous or other carriers). Emulsions containing lipids will enhance penetration of the active ingredient into the skin of the ear, however, most of these ointment formulations are so viscous, that they fail to penetrate down deep into the ear canal. They are especially ineffective in the presence of a heavy growth of hair in the canal. Less viscous medications are more likely to allow medication to distribute deeper into the canal, especially when there is significant hair in the ear canal or when the canal is hyperplastic.

IN all cases when topical therapy is used, the owners MUST be educated about application of medications. This should include having the owner instill medication, IN THE PRESENCE of the veterinarian or technician. Owners should be taught to massage ears for 15-30 seconds after instilling medications…and to use proper amounts of medications. Once-daily treatment is generally sufficient for most cases of otitis, though severe infections may benefit from twice daily treatment. Treatment should be continued until there is no clinical or cytologic evidence of active disease. The minimum recommended treatment time (with topical therapy) is 30 days.

**Dose (volume) recommendations:**

<table>
<thead>
<tr>
<th>Dog Size</th>
<th>Recommended Dose</th>
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<tbody>
<tr>
<td>Small dogs (&lt;10 kg)</td>
<td>0.4-0.5 ml</td>
</tr>
<tr>
<td>Medium dogs (10 – 20 kg)</td>
<td>0.5-0.7 ml</td>
</tr>
<tr>
<td>Large dogs (&gt; 20 kg)</td>
<td>1.0 ml</td>
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The volume of medication applied into the ear during treatment appears to be critical. We recommend using dose syringes to accurately measure otic medications. Failure to apply sufficient quantities to penetrate to these areas seems to be a major cause of treatment failure.

Keep in mind that higher volumes of otic medication may increase the likelihood of absorption of otic medications, especially glucocorticoids. It is important to understand that there may be systemic side effects as more potent glucocorticoids are used.

The integrity of the tympanic membrane is critical in determining the best treatment options for a patient with otitis. As discussed previously, the chance for ototoxicosis is greatly enhanced if the medication is instilled directly into the middle ear. To the author’s knowledge, no commercial ear medications have been evaluated for the potential to cause ototoxicosis if the medication is instilled into the middle ear. The best practice is to avoid topical therapy, if the tympanic membrane is torn or absent. However, there are some clinical indications, based entirely on anecdotal evidence, that vinegar: water (1:2), dilute ticarcillin (3%) in saline, and enrofloxacin (parenteral formulation) are fairly safe.

Topical therapy is considered sufficient to manage most cases of otitis externa, if the principles of therapy discussed early are followed. In general systemic therapy is indicated when:
- The infections are recurrent and severe
- There are concurrent infections elsewhere, such as the skin, that would respond to the therapy
- When the owners are incapable of treating topically (e.g., arthritis, elderly owner)
- When the patient is entirely uncooperative
When there is severe hyperplastic changes in the canal that preclude the ability of topical medications to distribute deeper into the ear canal.

Systemic antibacterial therapy is indicated when inflammatory cells are seen on cytology, when a pure infection of a gram-negative bacteria is present, in recurring bacterial infections, when ulcers are present in the external ear canal, or when systemic signs accompany the otitis. The antibiotic selection depends upon the organism isolated. Drugs should be dosed at the high end of the recommended range…always go up on pill size, never skimp on systemic drug doses! Drugs should be administered for a minimum of three weeks, then the patient re-examined.

Clinical Significance: Wow! If treatment, topical or systemic, is not done following correct principles, it stands to reason that treatment will fail….even if the correct medications are used.

#5 – Clients Must Be Educated and Involved

Yea, this point may be a "no-brainer" but I’m sure it was an area that I could have improved upon when in practice, AND in truth, it remains an issue with most of the cases that are referred to our referral practice.

First, remember that all of dermatology is a bit like archeology…. A point I’ve made before. That is, clinicians must keep on digging until they find the underlying civilization (i.e., primary factor). I’m talking about Point #3 that I made earlier. If the clinician does not address the underlying problem, then the perpetuating (i.e., secondary) factors will fail to respond to treatment or will recur. So, it makes sense to explain this to clients at the beginning, understanding that it is unlikely that a client will give consent to spend a lot of time and money searching for a cause of first-time otitis. But….you plant the seed by giving them the education about the pathogenesis of otitis. That way, when the problem recurs (notice I didn’t say “if”), they just may remember that you tried to explain this to them.

Second, ear models are great for explaining otitis. Several companies have provided these to veterinarians in the past, so ask your reps about one! It is especially helpful to explain the “L” shaped ear canal and why we have to medicate the way we do.

Last, video otoscopes also help the clients be more involved. Clients LOVE seeing their pet’s ears before and after cleaning or before and after treatment. If they are cleaning the ears at home, this is a great opportunity to give them feedback on technique. Many clients even learn to ask for photos of the ears at each visit so that they can keep a running log of the problem. Letting clients see the ears will definitely help to convince them that cleaning and medications are warranted.

Clinical Significance:
1. Better client compliance
2. More cooperative clients
3. Better success with treatment plans
4. More revenue with less hassle
5. Bigger house, better car, more money for Uncle Sam, etc.…everybody wins.

Summary

These five points can change the way you address otitis cases and make veterinary practice more enjoyable. There are a whole lot more “tips” and essentials for dealing with ear disease, and I admit that I put more than five in here….I just want you to enjoy ear disease as much as I do!