

Bear's Chronic Dilemma

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Introduction

Otitis externa is the inflammation of the external ear canal distal to the tympanic membrane and is one of the most common complaints for small animals to present to a veterinary clinic.^{1,6} Otitis externa can be acute, chronic, unilateral, or bilateral. This disease process can also present in smaller exotic pets, such as rabbits, and is typically uncommon in large animals.

The etiology for otitis externa can be separated into causes and factors. There are both primary and secondary causes that can be attributed to different diseases or infectious agents that result in otitis. Perpetuating and predisposing factors may contribute to or promote otitis externa. Either of the factors will often result in otitis due to the alteration of the structure / function of the ear canal itself.⁷

Primary causes of otitis externa create disease in a *normal* ear. They will alter the environment within the ear, often allowing a concurrent secondary infection to develop. Although ultimately all factors and causes need to be addressed, primary causes in particular must be managed to reduce the continuation or recurrence of otitis. Secondary causes of otitis externa create disease in an *abnormal* ear. These are often chronic, reoccurring problems that persist due to a primary cause not being addressed. Perpetuating factors occur due to inflammation and can be severe in chronic cases. Predisposing factors increase the overall risk of developing otitis externa and are present *before* the ear develops disease. This contrasts with perpetuating factors that occur as a result of the disease itself. Each of the causes and factors are discussed at length in a later section.⁷

History & Presentation

Bear is a 9-year-old intact male Labrador Retriever mix that presented to Mississippi State University College of Veterinary Medicine on November 6, 2019, for re-evaluation of non-seasonal atopic dermatitis and chronic ear infections that only partially resolve with medical management. Bear's allergic conditions and ear infections originally were reported in January of 2011. Over the next eight years, Bear continued to be treated for recurring ear infections, pododermatitis, and atopic dermatitis.

Bear was maintained on Apoquel (16mg) 1 tablet orally every 24 hours or every 12 hours, if needed, in order to manage his atopic dermatitis. Other treatments for his skin condition(s) included: Terbinafine (250mg), Cephalexin (500mg & 250mg), TrizCHLOR-4HC Spray, and Ketoconazole (200mg). Bear was also enrolled in a food trial with Hill's z/d being fed exclusively for approximately 1 year, and his medications were given in z/d canned food. However, this diet exclusion trial was ineffective at helping mitigate his allergies.

In attempting to control his chronic ear infections, different culture and sensitivity tests were performed with the most recent culture, prior to presentation, revealing heavy growth of *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Enterococcus faecalis*, and *Corynebacterium spp.* In accordance with sensitivity recommendations, Bear was prescribed Compounded Otic Solutions including Baytril, Silver Sulfadiazine 0.2% in Saline, Amikacin 1% with Dexamethasone 0.2% in EpiKlean, and Synotic Solution. Unfortunately, medical management and treatments only reduced the amount of discharge and odor related to the infection(s) initially, and the clinical signs associated with the primary infection continued.

At presentation on November 6, 2019, Bear was bright, alert, and responsive and had finished his ear medications, described above. The foul odor previously described was less

pungent but the pruritic ears and shaking of his head had persisted, with clinical signs being considerably worse in the left ear. At that time, salivary staining, erythema, and alopecia were appreciated along the palmar aspect of all four feet, and lichenification of the dorsal aspect of the digits of the forelimbs was noted. Due to inadequate response to the diet elimination trial, Bear was no longer being fed Hill's z/d and instead had been transitioned to Purina One exclusively.

At presentation, Bear weighed 75.9lbs (34.5kg) and had a body condition score of 6 / 9, with 4-5 / 9 being ideal. His heart rate was 84 beats per minute, respiratory rate of panting, and a rectal temperature was not taken. Bear's eyes were bright and clear of discharge. A full neurologic examination was not performed, but cranial nerves appeared to be intact. Bear's ears were abnormal bilaterally. The left ear canal was severely erythematous and an oily exudate with tan-brown debris was noted to be draining from within the internal canal. The left ear was also noted to have a very foul odor. Complete examination of the horizontal ear canal of the left ear was not permitted, at that time, due to poor patient compliance. Evaluation of the right ear revealed that the canal contained minor debris, was mildly-to-moderately erythematous, and the tympanic membrane was noted to be intact.

Bear's oral mucous membranes were moist and pink with a capillary refill time of less than 2 seconds (ideal) and a normal skin tent was observed. Cardiopulmonary auscultation was normal, with no crackles, wheezes, murmurs, or arrhythmias being appreciated, and his femoral pulses were strong and synchronous with his heart. Bear's abdomen was soft and non-painful during palpation. Both testicles palpated normally within the scrotum. A rectal examination was not performed. Bear's palpable lymph nodes were uniform and symmetrical, although the popliteal lymph nodes were slightly enlarged bilaterally. The remainder of the general physical examination was within normal limits.

Presentation of Disease & Diagnosis

Currently, there is no recognized age or sex predilection for the development of otitis externa.^{6,7} However, breed predisposition for otitis parallels closely to those which are predisposed to skin disease (ex., allergies in terriers and retrievers).^{6,7} Clinical signs associated with otitis externa can include combinations of head shaking, pruritus of the pinnae, aural pain and malodor, exudate, ear canal erythema, erosion / ulceration of the canal, inflammation, or glandular (ceruminous) hyperplasia.^{2,6,7} Diagnosis for this disease is largely based on history provided by owner(s), otoscopic examination, cytology, and concurrent allergies such as atopic dermatitis or food hypersensitivity.¹ It is important to note that sampling (mineral oil preps, cytology, culture and sensitivity if necessary) should be taken *before* cleaning of the ear canal(s). Sampling of the inner surface or edges of the pinnae may include cytologies (yeast, bacteria, inflammatory cells), skin scrapes / mineral oil preps (*Demodex*, *Sarcoptes*), or DTM-culture.⁷

Following a thorough physical exam, an extensive dermatologic evaluation should be conducted. External assessment of the pinnae should be evaluated first and includes the observation for signs described above. External palpation of the ear canals and pinnae can help assess for the presence of pain, swelling, and development of mineralization of the aural cartilage (due to chronicity). If possible, an otoscopic evaluation should be performed on *all* dermatologic patients. Sedation may be required for extremely painful patients before further aural examination is permitted. A handheld otoscope is typically satisfactory. However, a digital otoscope may provide additional visualization of pathological changes.

During an otic exam, the internal canal should be evaluated for stenosis, erythema, erosion / ulceration, glandular hyperplasia, exudate, and masses / foreign bodies. If possible, the tympanic membrane should be assessed for changes in opacity, distention, or rupture. Cleaning

and flushing of the canal may be required if the membrane is not visible due to the presence of exudate in the horizontal canal.

Cytologic evaluation of exudate from the ear canal may support an immediate diagnosis. However, the external ear canals of most dogs and cats harbor normal commensal bacteria and yeast. Despite these organisms being considered normal flora, they can become pathogenic if the microenvironment is changed to permit overgrowth. Coccal bacteria are usually staphylococci or streptococci. Rod-shaped bacteria are usually *Pseudomonas aeruginosa*, *Escherichia coli*, or *Proteus mirabilis*. Yeast is most commonly *Malassezia pachydermatis* and will frequently overpopulate the ear canal with otitis externa. Otic exudate should also be examined for eggs, larvae, or adults of the ear mite *Otodectes cynotis* and *Demodex spp.* mites in dogs and cats, and *Psoroptes cuniculi* in rabbits and goats. Dark, “coffee-ground” exudate in dogs and cats is highly suggestive of *Otodectes cynotis*.^{2,5,6}

In cases of chronic, non-responsive, obstructive, unilateral otitis externa advanced imaging, beyond radiographs, and biopsies can help provide a clearer assessment of pathological changes that have occurred as well as reveal presence of neoplastic changes.^{4,8} Advanced imaging may also be required for patients with ear canals that have developed severe chronic changes, or for those with suspect underlying conditions, such as neoplasia and glandular hyperplasia. Of the imaging modalities, computed tomography (CT) is preferred, as it will provide a clearer assessment of the osseous bullae and is indicated when proliferative tissues prevent visualization of the ear canal and tympanic membrane.^{4,8} Such cases can include suspicion of otitis media as a cause of refractory otitis externa, or when neurologic signs are present with a diagnosis of otitis externa. In addition to providing a more complete diagnosis, a CT-scan or MRI is typically warranted in cases of severe, chronic, refractory otitis externa.

Pathophysiology

The etiology for otitis externa can be separated into causes and factors. There are both primary and secondary causes that are attributed to different diseases or infectious agents that induce otitis. Perpetuating and predisposing factors may contribute or promote otitis externa. The factors will often result in otitis due to the alteration of the structure / function of the canal itself.⁷

Primary causes of otitis externa create disease in a *normal* ear. These causes can alter the environment within the canal, often allowing a secondary infection to develop. Although all factors and causes need to be addressed, primary causes must be managed to reduce the continuation or recurrence of otitis. Primary causes can include the following.⁷

- Allergy (food hypersensitivity, atopic dermatitis, contact hypersensitivity)
- Autoimmune / immune-mediated disease (pemphigus foliaceus)
- Keratinization disorders (sebaceous adenitis, zinc-responsive dermatitis)
- Endocrine disease (hypothyroidism, hyperadrenocorticism – “Cushing’s”)
- Parasites (*Otodectes*, *Demodex*)
- Foreign bodies
- Fungal disease (*Aspergillus*)
- Glandular disorders (sebaceous gland hyperplasia)
- Miscellaneous (juvenile cellulitis)
- Viral (Canine Distemper Virus)

Secondary causes of otitis externa create disease in an *abnormal* ear. These are often the result of chronic / recurrent primary causes which have not been addressed or treated properly.

Secondary causes can include the following.⁷

- Bacterial (*Staphylococcus*, *Streptococcus*, *Enterococcus*, *Pseudomonas*, *Proteus*, etc.)
- Medication reactions (i.e. Cutaneous Adverse Drug Reactions)
- Overcleaning
- Yeast (*Malassezia spp.*)

Perpetuating factors occur due to inflammation and can be severe in chronic cases.

These can include the following.⁷

- Changes of the ear canal (stenosis, proliferative changes)
- Epithelial changes (failure or alteration of the natural aural defense within the ear – i.e. Migration of the epithelium in the ear canal provides a natural cleansing mechanism in normal ears)
- Glandular (sebaceous gland hyperplasia)
- Cartilaginous fibrosis or calcification (chronicity)
- Ruptured tympanic membrane with the presence of otitis media

Predisposing factors increase the risk for developing otitis externa and are present *before* the ear disease develops. This contrasts with perpetuating factors that occur as a result of the disease. Predisposing factors can include the following.⁷

- Conformation (pendulous pinna, breed-related stenotic canals, excessive hair in canals)
- Excessive moisture (environment, swimming)
- Systemic disease (immune suppression, catabolic states)
- Treatment effects (changes in normal flora, trauma)

Treatment & Prevention of Disease

Successful treatment of otitis externa requires owner compliance, specific antimicrobial therapy, management of inflammation, and identifying the underlying cause of the disease. It is crucial that owners are provided reasonable expectations and understand that treatment of disease will require time to improve or resolve otitis externa.^{1,7}

Management of pain and pruritus associated with the disease should be started with initial treatment. Glucocorticoids are commonly used to reduce the inflammation that leads to swelling and pain and are also used to help decrease the “itch-sensation”. By reducing the pain

and swelling associated with otitis, an owner's ability to successfully treat and clean the animal's ears at home is increased.

Along with reducing inflammation and pain, overall ear hygiene is vital to the resolution of otitis. In some breeds, such as poodles, hair may need to be clipped / plucked from the periauricular area, as well as excess hair along the medial aspect of the pinnae. By removing the excess hair around the aural area, cleaning and treatment can be more targeted and therefore more successful.

Selection of an ear cleaner should depend on the type of infection / exudate that is present.¹ Infected ears with dry, waxy, thick material may require cleaning a few times a week with a cerumenolytic cleanser solution such as carbamide peroxide or dioctyl sodium sulfosuccinate (DSS). However, some ingredients within cerumenolytic cleansers need to be flushed from the canal to avoid irritation. Ears that contain copious amounts of purulent discharge likely require cleaning twice daily initially. If large amounts of rods are seen at diagnosis an ear cleaner should be standard of care and the ear should be cleaned under sedation prior to treatment at home. This is due to the pathogenic capability of rods, such as *Pseudomonas*, to produce a biofilm that inhibits the overall effectiveness of antibiotics / cleansers.^{1,6}

In addition to cleaning and hygiene, effective treatment may require both topical and systemic antimicrobial and anti-inflammatory therapy. Indications for systemic therapy include severe otitis externa / otitis media, poor patient / owner compliance, or cases of suspected topical adverse reactions. Depending on the severity at the time of diagnosis, the duration of treatment may vary from 7–10 days, to months.^{1,6} Most commercial topical products contain a combination of an antibiotic, an antifungal and a glucocorticoid. For example, treating an acute case of

bacterial otitis externa, topical antibacterial agents in combination with corticosteroids can greatly reduce the amount of exudate, pain, swelling, and bacterial overgrowth associated with disease, and are usually successful. In addition to cleansers, systemic glucocorticoids can be used in both acute and chronic otitis externa to help manage pain, inflammation, and swelling. However, dosing should be adjusted when using both systemic and oral glucocorticoids in the management of otitis externa. Chronic, severely stenotic ears in dogs may require doses equivalent to 1-2 mg/kg/day of prednisone for 7-10 days, to allow for an otic exam to be permitted.^{1,6} This dose maximizes the chance that the ear can be medically managed, rather than require a surgical procedure, such as a Total Ear Canal Ablation & Bulla Osteotomy (TECA-BO).^{1,3,7} However, this dose should not be maintained long-term, and proper management of the underlying disease and secondary infections is required. Systemic antibiotics are not typically required in cases of otitis externa but should be used when otitis media is suspected, or when there is systemic atopic dermatitis resulting in skin infections.^{1,6,9}

Judicious use of systemic antibiotics is paramount. Therefore, the selection of medications used should be based on culture and sensitivity. Most cases of otitis externa with yeast respond well to topical therapy, but systemic antifungals such as ketoconazole (dogs) or terbinafine (dogs and cats) may be helpful if unresponsive to topical medications alone.^{1,6,9} In addition to judicious antimicrobial use, duration of treatment should be specific for each individual case while continuing past resolution of the infection for at least seven days, and longer in cases of otitis media.^{1,6,9} Resolution of disease should be based on re-examination and repeat cytology of the previously affected ear(s). For most acute cases, treatment typically takes 2–4 weeks, whereas chronic cases may take several months to resolve. If cases of otitis externa do not resolve despite addressing underlying conditions, appropriate therapy choice, owner

compliance, appropriate duration of therapy, or re-evaluation further work up should be considered.

It is important to notice that methicillin-resistant *Staphylococcus intermedius* and *Pseudomonas* otitis (caused by *Pseudomonas aeruginosa*) have emerged as frustrating and difficult perpetuating causes of otitis.⁹ This is due to the development of resistance to most common antibiotics used to treat uncomplicated cases of otitis. These infections with resistant pathogens are often chronic in nature, lasting longer than two months, and can be associated with severe exudate production, epithelial ulceration, pain, and mineralization of the canal.

Successful treatment for resistance is multifaceted and should include the following steps.^{7,9}

- Identify the primary cause of the otitis
- Remove the exudate via cleaning and flushing of the ear canal
- Identify and treat concurrent otitis media
- Select a specific antibiotic from the results of culture and sensitivity and mean inhibitory concentration on the organism and use it at an effective dosage for an appropriate duration
- Treat topically and systemically past resolution of disease

Topical therapy should be directed towards the secondary infection and is necessary for successful treatment. When choosing a topical antibiotic, those that are not likely to be needed for systemic use should be used first. Examples such as Gentamicin, Polymyxin, or Neomycin should be considered a first-line treatment for uncomplicated otitis.^{1,7,9} Gentamicin and fluoroquinolone antibiotics should not be used unless absolutely required for successful treatment.^{7,9} Polymyxin-B and fluoroquinolone antibiotics have most successfully controlled *Pseudomonas* infections in cases in which resistance has been noticed by failure to clinically respond. However, resistance is rapidly developing to fluoroquinolones because of unnecessary

use, so responsible antibiotic stewardship should mean they are reserved as a last-resort treatment, with the exception of a culture revealing *Pseudomonas spp.* Lastly when choosing for a topical antifungal agent, it is important that there be a generalized otic cleanser along with medication that can include Miconazole, Clotrimazole, or even Silver sulfadiazine (mild cases).

Diagnostic Approach & Case Outcome

During the appointment on November 6, 2019, the foul odor coming from Bear's ears was less pungent, but the pruritus and shaking of his head persisted. Although Bear's ears were abnormal bilaterally, the left ear was considerably worse. The ear was severely erythematous and an oily substance with debris was noted to be draining from within the internal canal. The lower canal of the left ear could not be visualized during the time of the initial dermatologic exam, due to poor patient compliance. However, a previous exam at a prior visit detailed the suspicion of a suspect mass within / occluding the canal distal to the tympanic membrane.

In order to visualize the left ear canal properly, Bear was sedated with 0.35mLs of Dexmedetomidine (0.5mg/mL) and 1mL of Butorphanol (10 mg/mL), and later reversed with 0.35mLs of Atipamezole (5mg/mL). While sedated, Bear's ears were sampled and then copiously cleaned and flushed, with the left ear being of greater concern. The ear canal was filled with a dark brown-green exudate and was severely erythematous. Cytology results showed that Bear's previous infection was still present and was not regressing despite treatment. Results included that the left ear contained too numerous to count cocci and rod-shaped bacteria at 100xhpf, no yeast noted. The right ear had few (0-5) yeast at 100xhpf, no bacteria noted – this was determined to be normal amounts of yeast in this ear and no treatment was required.

As presumed at a previous visit, a suspect mass / swelling was appreciated in the left

horizontal ear canal that appeared to be adjacent to and occluding visualization of the tympanic membrane. Due to Bear's progressively worsening condition and severe otitis a computed tomography (CT) scan was recommended to and approved by the owner to be performed on November 6, 2019. CT-scan findings showed that within the medial aspect of the left horizontal ear canal and extending into the left tympanic bulla, there was an irregularly shaped, irregularly margined, heterogeneously soft tissue dense, strongly heterogeneously contrast enhancing mass that measured 1.8 x 2.1 x 1.7cm. Contrast enhancing material was also present within the internal ear on the left. The mass was also characterized to have variably shaped and sized, sharply margined, mineral dense foci throughout. Several areas of mineral dense foci were also appreciated within the cartilages of the external and horizontal ear canals bilaterally.

In addition to the mass itself, the left tympanic cavity was greater than 90% filled with non-contrast enhancing heterogeneous soft tissue dense material. The wall of the left tympanic bulla was mildly thickened and irregularly margined as compared to the right and was also characterized to have permeative lysis of the most rostroventral aspect of the tympanic bullae.

Considerations for the mass within the left horizontal ear canal included neoplasia (squamous cell carcinoma, adenocarcinoma, cholesteatoma, or other), abscess, and granuloma. Considerations for the heterogeneous soft tissue swelling surrounding the mass and horizontal ear canal include metastatic extension, edema, and cellulitis. Otitis media and externa, with a potential component of interna, were considered for the changes to the left tympanic cavity, osteolysis of the left tympanic bulla, and changes to the left horizontal ear canal. Chronic pathologic changes due to otitis externa or age-related change are considered for the dystrophic mineralization within the cartilages of both external ear canals.

Following further otic examination and CT-scan results, Bear was evaluated by the MSU-

CVM Surgery Department. The findings supported a possible mass that was likely present just distal to Bear's tympanic membrane and was partially occluding the inner ear canal. Surgery consultation provided that, in the best interest for Bear's quality of life, a Total Ear Canal Ablation and Bulla Osteotomy (TECA-BO) be performed. This decision was made in consideration with the results of the CT-scan, and the understanding that the current disease process would continue to be refractory to medical management. This solution was provided to and approved by the owners as the best option to inhibit further damage associated with the chronic infection and remove the mass from the area for further evaluation.

Five weeks later, on December 11, 2019, Bear presented to the MSU-CVM Surgery Department for a scheduled TECA-BO procedure to be performed the following day. On December 12, 2019, Bear underwent a TECA-BO to resolve the chronic otitis externa. The ear canal was dissected away from the surrounding soft tissues, with care being taken to identify and avoid severing the facial nerve at the caudolateral aspect of the base of the vertical ear canal. Due to the chronicity of disease and the pathologic changes the nerve required careful dissection away from the ear canal, where it was tightly adhered. Following the removal of the entire ear canal, the mass, which was adjacent to the canal, was also removed. After excision of the mass, the external acoustic meatus was widened to allow visualization inside the tympanic bulla. A curette was used to remove the glandular epithelium from the entire internal surface of the bulla to prevent fistula formation. Tissue and debris removed from within the bulla were submitted for both aerobic / anaerobic cultures and the excised ear canal and associated mass were submitted for histopathologic evaluation.

The report of the ear canal confirmed the presence of hyperplastic (thickened) epithelium in all cross sections. In select areas of the canal the dermis was markedly expanded by increased

collagen and occasional hyperplastic and disorganized adnexal glands (characteristic of fibroadnexal dysplasia). The thickened epidermis was described as being frequently covered by multiple layers of compact non-nuclear and sometimes nucleated keratin (orthokeratotic and parakeratotic hyperkeratosis). Multifocal ceruminous glands, from within the canal, were found to be dilated, lined by attenuated epithelium, and filled with inspissated fluid. However, neoplastic features were not appreciated within the ear canal.

The histologic changes of the ear canal discussed above are supportive of chronic otitis externa and media. The cellular composition (lymphoplasmacytic and eosinophilic) and perivascular and periadnexal distribution of the inflammation suggest that an underlying hypersensitivity or allergic dermatitis may have played a role in the development of the otitis. The nodules appreciated grossly and histologically within the dermis of the canal represent benign fibroadnexal dysplasia.

Fibroadnexal dysplasia is a common non-neoplastic lesion of adnexal appendages occurring in dogs. This lesion occurs most commonly on the distal aspect of the limbs but may develop anywhere on the skin. Animals are generally middle-aged or older, and large breed dogs, particularly Labrador Retrievers, appear to be predisposed. The underlying etiology of fibroadnexal dysplasia is controversial but likely related to chronic localized irritation or trauma.

Histopathology of the smaller mass was supportive of a ceruminous gland neoplasm, specifically a ceruminous gland adenocarcinoma. Ceruminous gland adenocarcinomas arise from specialized sweat glands within the external ear and have the potential to be locally invasive and can often metastasize to the regional lymph nodes. These neoplasms are more frequently observed in cats but can occur in dogs.

Bear recovered well post-operatively and was discharged by the MSU-CVM Surgery

Department on December 14, 2019, with discharge instructions detailing Bear's surgery and diagnosis. A metastasis check and a consultation with a veterinary oncologist were advised. Ultimately, Bear's otitis originally began as a bilateral issue that was largely due to an underlying primary cause – atopic dermatitis. However, as time progressed the bilateral disease became more unilateral. This development is most likely due to the mass that was adjacent to the left ear canal. This case serves not only as a crucial reminder to all veterinarians to re-evaluate both ear canals when managing otitis, but also emphasizes that there are different causes of otitis beyond “just allergies”.

As of January 21, 2021, Bear's owners could not be contacted for a follow up.

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