

## **Otitis Externa and Otitis Media**

Allison Foster, DVM, Diplomate ACVD  
Western College of Veterinary Medicine

### **Anatomy:**

Most dogs have hairs present in their ear canal, but these hairs decrease more proximally in the canal. There is usually a cluster of few fine hairs just distal to the tympanic membrane which is a useful landmark when the tympanic membrane cannot be clearly visualized. In addition to hairs, both sebaceous and apocrine glands can be found in the external ear canal. Sebaceous glands are more prominent in the distal canal (closer to pinna). These glands are more superficial, and their ducts open directly into the hair follicle. Ceruminous glands are found deeper in the dermis and are more prominent in the proximal aspect of the ear canal. Their ducts open into the hair follicle or the surface of the external ear canal.

Cerumen is normal and coats the ear canal. It is comprised of desquamated keratinized squamous epithelial cells, secretions from ceruminous and sebaceous glands and immunoglobulins. Cerumen helps to form a protective barrier for the ear.

### **Tympanic Membrane:**

The tympanic membrane (ear drum) separates the external ear canal from the middle ear canal. It is separated into two sections, the upper part, the pars flaccida which contains blood vessels, and the lower part, the pars tensa, which is where the manubrium of the malleus attaches. The tympanic membrane usually heals within 21-35 days when ruptured.

### **Epithelial Migration:**

The ear has a process of self-cleaning in which cerumen, bacteria and yeast are cleared by the movement of the epidermis. The surface of the skin of the tympanic membrane and the ear canal is constantly moving from the ear drum toward the opening of the external ear canal. As the surface epithelial cells move, they carry any debris that is on top of them. Age slows this process. When the rate slows to the point of accumulating debris, this is termed failure of epithelial migration.

## **Otitis Externa:**

Otitis is defined as inflammation of the ear canal; the focus of inflammation can be isolated to the external ear canal (otitis externa), the middle ear (otitis media) and/or the inner ear (otitis interna). A classification system has been designed to better determine the causes and factors that contribute to ear disease. The classification scheme has been broken into four components, primary causes, secondary causes, perpetuating factors, and predisposing factors. Causes are diseases or agents that directly create inflammation in the ear. Factors work in conjunction with causes to contribute to ear disease and can inhibit response to treatment or cause a recrudescence of disease. It is important to understand how each of these factors and causes influence ear disease to ensure a more successful therapeutic outcome. The following explanations are derived from Muller & Kirk's Small Animal Dermatology, 7<sup>th</sup> edition.

### **Primary Causes:**

The primary cause is the inciting event that directly causes damage or inflammation to the ear skin. These can occur without any other causes or factors and oftentimes are not noted until the animal develops secondary causes. It is important in treating otitis externa that the primary cause be identified and appropriately addressed. Common primary causes of otitis externa include: hypersensitivities (atopic dermatitis, food hypersensitivity), parasites (*Otodectes cynotis*, demodicosis), foreign bodies (such as plant awns), epithelialization disorders or autoimmune disease (sebaceous adenitis, Vitamin A responsive dermatosis, pemphigus foliaceus, etc.), metabolic disorders (hypothyroidism and hyperadrenocorticism), and obstructive ear disease (polyps/tumors which alter normal epithelial migration and allow cerumen build up which predisposes to secondary bacteria and yeast – some people consider this a predisposing factor as the mass generally occurs without otitis externa being present).

### **Secondary Causes:**

In the abnormal ear, secondary causes contribute to or cause pathology; they can work in association with primary causes or predisposing factors. When secondary causes are recurrent, then that usually means the primary causes or perpetuating factors have not been adequately addressed. Secondary causes are bacteria and yeast, including *Staphylococcus*, *Streptococcus*, *Enterococcus*, *Pseudomonas*, *Proetus*, *Klebsiella*, *Escherichia coli*, *Corynebacterium*, and *Malassezia pachydermatis*.

Other secondary causes include topical medication reactions and overcleaning, which can lead to excessive moisture and tissue maceration.

### **Predisposing Factors:**

Predisposing factors increase the risk of developing otitis externa by working in conjunction with primary causes, secondary causes, or perpetuating factors to cause clinical disease. These factors are present prior to the development of otitis externa, but in and of themselves, do not usually cause disease! Rarely, predisposing factors can work in conjunction with secondary causes to create disease, without a primary cause being present. However, this is not the norm and so an underlying primary disease should still be sought.

Some common predisposing factors in the dog are conformation (pendulous pinnae, hairy ear canals) and excessive moisture from swimming or bathing.

Ear plucking should not be routinely performed in dogs except in instances where hair impedes treatment or actively contributes to disease. It should not be performed excessively as plucking can cause inflammation and lead to recurrent otitis.

### **Perpetuating Factors:**

Perpetuating factors occur following the development of otitis externa and result in the alteration in the anatomy or physiology of the external ear canal, tympanic membrane, and middle ear cavity. These changes in the normal anatomy interfere with resolution of otitis and promote secondary infections.

Chronic inflammation stimulates changes, including epidermal hyperkeratosis and hyperplasia, dermal edema, and fibrosis, and cerumen gland hyperplasia and dilatation. Breed variations do exist; for instance, the Cocker Spaniel develops more cerumen gland hyperplasia and ectasia in comparison to other breeds, but less fibrosis. These chronic changes result in thickening of skin, stenosis of the canal and the development of numerous folds which inhibits effective cleaning and acts as a site for accumulation of exudate and perpetuation of secondary infections. The hyperkeratotic stratum corneum exfoliates and that keratin debris favors bacterial overgrowth. These progressive changes may halt epithelial migration.

Lastly, otitis media can act as a perpetuating factor. In the dog, otitis media typically is secondary to otitis externa and can act as a nidus for recurrent otitis externa. Clinical signs of otitis media can include recurrent otitis externa, an abnormal tympanic membrane (not

necessarily ruptured – it will heal and can appear thickened, or abnormal), pain on palpation at the base of ears or on opening mouth/chewing, facial nerve paralysis or Horner's syndrome, and signs consistent with otitis interna, such as head tilt or peripheral vestibular signs. Although CT, MRI and radiography are all used as diagnostic tools for otitis media, CT is generally recommended as it is a more sensitive modality in comparison to radiography and is more readily available and cost effective compared to MRI.

### **Diagnosis:**

A thorough history should be taken in every animal presenting for otitis externa. This will help determine underlying causes and factors. Additionally, a thorough physical and dermatological examination should be performed.

### **Otoscopic Examination:**

If possible, in every case an otoscopic examination should be performed in both ears. This will allow for visualization of tumors, foreign bodies, pathologic changes, etc. The unaffected ear should be assessed first, to avoid premature sensitization of the patient to the procedure. It is important to change cones between ears to avoid cross contamination. Changes within the ear should be noted in the record.

### **Cytology:**

Cytology should be taken from both ears and all results recorded, including whether yeast, bacteria (rods, cocci) and/or neutrophils are seen. Smell cannot make this diagnosis. Knowing what you are treating is important for therapeutic success and also for monitoring treatment. It is also important to note if neutrophils are present as this can help guide treatment choices.

If mites are suspected, a mite prep should be performed.

### **Culture:**

Culture should not be performed without first having done cytology. Topical therapy does not always correlate with culture results. Cultures indicate attainable drug levels in plasma; however, topical therapies can achieve levels exceeding 100 – 1000xs what can be achieved in plasma. Bacteria are thus exposed to higher levels of drug. Therefore, susceptibility testing may not be clinically relevant.

It should always be performed prior to starting systemic therapy. I will also culture if suspicious that *Pseudomonas* is present.

### **Treatment:**

Treating otitis externa requires a multifactorial approach. Client education is crucial – owners should be advised that the condition can be recurrent unless all the causes and factors are appropriately addressed. Additionally, they need to be educated on the importance of recheck examinations with cytology. Failure to recheck ears could result in inadequate treatment and “recurrent” infections. Advising owners to treat until “things are better” often results in treatment failure.

### **Ear Cleaning:**

Ear cleaning does not routinely need to be performed in clean, healthy ears; however, it can be an essential part of the treatment regimen in otitis externa. Ear cleaning aids in removal of retained exudate which can inactivate certain medications (such as Polymyxin B and gentamicin) and impair examination. It also removes toxins, cellular debris and microorganisms which decrease stimulation for further inflammation and aids when there is a failure of epithelial migration. Owners should be advised to avoid use of cotton-tipped applicators when cleaning at home.

### **Types of Cleansers:**

Ceruminolytics – organic oils and solvents used to soften and dissolve cerumen in mildly waxy or dirty ears. In most cases, these products are safe for at home cleaning if the tympanic membrane is intact. Examples of common ceruminolytics include propylene glycol and lanolin.

Ceruminolytic Surfactants – These products help expedite the cleaning process by emulsifying debris, such as ceruminoliths. These products can be very irritating to the epithelial lining in the external ear canal and middle ear; it is important to flush after use to avoid this irritation. For this reason, I do not recommend dispensing these products to clients for at home use. Example of surfactant include dioctyl sodium sulfosuccinate.

Almost all ceruminolytics can be ototoxic, although squalene has been shown to be safe in the middle ear.

Astringents – these are drying agents that dry the ear canal surface and prevent maceration. These products can be very painful in otitic and ulcerated ears. Examples include isopropyl alcohol, salicylic acid, acetic acid, and aluminum acetate.

Antiseptics – help control microbes in the ears without promoting resistance. Examples include isopropyl alcohol, aluminum hydroxide, parachlorometxylenol, propylene glycol and acetic, boric, benzoic, lactic, and salicylic acids.

TrizEDTA – treatment with this used 20 minutes prior to antibiotic therapy, may potentiate antibiotic activity when treating *Pseudomonas* infections.

Chlorhexidine is ototoxic in dog ears in concentrations greater than 0.2%. Due to potential sensitivity, chlorhexidine should never be used in the ears of cats.

Many of these products can be ototoxic and so avoid use in ears with ruptured tympanic membranes.

### **Deep Ear Flushes:**

A deep ear flush is performed to remove exudate that cannot be effectively removed with other therapies. Saline or other ceruminolytics can be used. Patients should be anesthetized to help prevent aspiration and movement of the head as this can be a painful procedure.

### **Topical Therapies:**

Generally, topical therapies are sufficient to treat most cases of otitis externa. Systemic medications are mostly used in cases of proliferative or ulcerative ear disease. Most topical ear medications contain a steroid, antifungal agent, and an antimicrobial.

It is important to understand the vehicle base in your product. In general, oil or ointment-based products moisturize the canal so may be more effective in disease with dry lesions. Solutions or lotions are recommended in moist lesions. In cases of chronic otitis externa, where the tissue is hyperplastic and the canals are stenotic, solutions or lotions or recommended as oils and ointments may not be able to penetrate into the canal as well.

Topical steroids are beneficial for several reasons: they are antipruritic and anti-inflammatory, decrease exudate and swelling, cause sebaceous gland atrophy, reduce scar tissue, decrease glandular secretions, and decrease proliferative changes. Although these are topical medications, there is some systemic absorption. This should be considered if your patient has underlying disease in which steroids are contraindicated or when analyzing blood work and prior to performing tests such as ACTH Stimulation or Low Dose Dexamethasone Suppression.

## **Treatment:**

Always perform a recheck examination **with** cytology prior to discontinuing therapy. Address underlying causes and discuss the possibility of recurrence with the owner unless all factors and causes are appropriately addressed.

In most cases of otitis externa, topical therapy is sufficient to effectively treat disease. Systemic disease is warranted when there severe proliferative or ulcerative ear disease is present. In these cases, oral antibiotics +/- systemic glucocorticoids are recommended in conjunction with topical therapies. Rarely are systemic antifungals necessary but in some cases may be beneficial.

### **How to approach chronic, severe otitis externa:**

The primary and secondary causes still need to be addressed, but now there are likely perpetuating factors as well. Dogs with chronic, recurrent otitis externa oftentimes have progressive pathologic changes to their ear canals, including stenosis and hyperplasia with subsequent disruption of epithelial migration. The changes to their ear canals act as perpetuating factors for otitis externa and oftentimes some form of chronic therapy is required including routine ear flushes and possibly topical steroids. In severe cases, where the ear canal is calcified or if the stenosis is severe enough and refractory to treatment, total ear canal ablation may be required.

Treatment for severe, chronic otitis externa, in which there is > 50% stenosis of the canal, involves topical therapies but oftentimes will require systemic corticosteroids as well unless contraindicated. There are at least two approaches to using systemic steroids:

1. Prednisone 1-2 mg/kg every 24 hours X 7 days, then taper to every other day. Recheck examination should be performed at 2 weeks.
2. Prednisone 1-2 mg/kg for up to one month, then taper. Recheck at 2 weeks – if improvement is seen, start taper then. If no response by one month, then taper.

Regardless of which approach is taken, recheck examination at two weeks is important to assess the canals and decide how next to proceed.

It is very important to choose these cases carefully, and owners should be fully apprised of all inherent risks associated with using high doses of steroids.

If the ear canal fails to respond to therapy and remains stenotic, then it is likely a total ear canal ablation surgery is needed. If the canal opens, then it is important to remember all the causes and factors which contribute to ear disease. If these are not addressed, then the infections and stenosis will recur.

Another perpetuating factor which can contribute to otitis externa is otitis media. Otitis media can occur in acute otitis externa or in chronic disease. Inflammation causes disruption of the tympanic membrane, allowing for exudate to pool in the middle ear. If otitis media is diagnosed, then treatment involves myringotomy, bulla osteotomy or total ear canal ablation surgery with bulla osteotomy. In most cases, medical management including myringotomy is tried initially prior to referring for surgical management. A myringotomy is performed by first flushing the external ear canal until clear. Once clear of debris and exudate, a small incision is made in the caudoventral aspect of the pars tensa using a sterile rigid polypropylene catheter cut at an angle or a myringotomy knife. I personally use a polypropylene catheter. A small amount of sterile saline is flushed into the tympanic bulla and aspirated for sample collection for cytology, aerobic and anaerobic cultures. The bulla is then flushed and suctioned using sterile saline. The catheter should be passed into the ventral portion of the bulla. (It is important to avoid using any irritating or ototoxic medications in the bulla directly. Some people may advocate for using different flushes in the middle ear, but I routinely will use sterile saline.) After the myringotomy is performed, then I switch to a catheter with a blunt end, so that I am not traumatizing the mucosa in the bulla.

Ideally treatment of otitis media is dependent upon topical antibiotics and steroids (again monitoring for which substances may be ototoxic.) This treatment does not work for every client given it can necessitate numerous anesthetic events for repeated infusions. Systemic antibiotics based on culture are oftentimes utilized in conjunction with topical antibiotics; however, it is important to remember that systemic antibiotics may not reach therapeutic levels in the tympanic cavity.



A video otoscope is not necessary for this procedure but is helpful in that it greatly enhances visualization. Risks with myringotomy can include peripheral vestibular signs, facial nerve paresis / paralysis, Horner's syndrome.

Surgical management of cholesteatomas are recommended as medical management is generally not successful.

Most cases of otitis media occur secondary to otitis externa; however, there are instances in which otitis media is primary. Primary otitis media can occur because of soft palate abnormalities, trigeminal nerve dysfunction / neoplasia, or upper respiratory infections. The latter is a common cause of primary otitis media in cats.

Otitis media with effusion, otherwise known as primary secretory otitis media or "glue ear" has been described in Cavalier King Charles Spaniels and other brachycephalic breeds. This condition is believed to occur secondary to the brachycephalic conformation. Dogs can present with a myriad of clinical signs including hearing loss, abnormal yawning, head shaking, head / neck pain, aural pruritus, neck scratching, otitis externa and neurologic signs. On otoscopic examination, affected dogs may have a bulging pars flaccida, but a lack of this does not negate the possibility of otitis media being present and imaging should be performed. Treatment involves myringotomy followed by topical +/- systemic corticosteroids and antibiotics. Mucolytics, such as N-acetylcysteine can be utilized, but may not be beneficial. Recurrence is common. Tympanostomy tubes can be used but require special equipment and placement.

Dogs and cat can both develop inflammatory polyps, but it is more commonly appreciated in the cat. Inflammatory polyps in cats are benign masses that arise from the middle ear mucosa, the Eustachian tube, or the nasopharynx. Cats will present with respiratory signs, otorrhea, or signs of otitis media / interna. On otoscopic examination, a smooth pink mass can oftentimes be identified in the external canal. If within the bulla or if neurological signs are present, then advanced imaging is needed to aid in diagnosis. Removal has traditionally been achieved through traction avulsion or bulla osteotomy. Traction avulsion can have a recurrence rate of 50%. Treatment with steroids post removal can lower the risks of recurrence. Traditionally, prednisolone 1-2 mg/kg daily for 2 weeks, followed by a taper over several weeks has been recommended. A recent abstract also reviewed using prednisolone in cats at a dose of 2-3 mg/kg tapered over a 6-18-week period showed no recurrence for a mean of 3.7 years. This was done in conjunction with topical otic steroids. (Bachtel J, Schissler J, Rosychuk R.) Recently other techniques for removal have been described with a better success rate, including traction avulsion after a lateral approach to the ear canal and per-endoscopic trans-tympanic traction.

Traction avulsion can result in neurological signs, such as Horner's syndrome or facial nerve paralysis. Owners should be advised of these risks prior to the procedure being performed.

Feline cystomatosis (cystadenomatosis) is a condition which causes cyst formation of apocrine sweat glands. The underlying cause of this condition is unknown, but cats present with dark blue, brown, or black masses affecting the pinnae and external ear canals. They can less commonly affect other areas, including periocular and perianal skin. Treatment options range from benign neglect to treatment using topical steroids, cryosurgery, CO2 laser ablation, or total ear canal ablation. Masses should be submitted for histopathology to rule out neoplasia.

When dogs develop *Pseudomonas* otitis, all the previously described primary causes (ie. allergies, endocrinopathy, tumors, foreign bodies) and perpetuating factors (ie. otitis media) should be explored. *Pseudomonas* is a difficult disease to treat due to the formation of resistance and biofilm formation. On clinical presentation, dogs will have excessive purulent exudate and, in most cases, ulceration. Ears are typically painful on examination and sedation, or anesthesia may be necessary to perform an otoscopic examination. Cytological examination typically reveals neutrophils and rod-shaped bacteria, although this may not be a pure population.

Treatment usually involves topical therapies unless there are concurrent signs of otitis media. An ear flush under anesthesia is recommended. Topical therapies include: TrizEDTA, fluoroquinolones, Polymyxin B (may not be as effective, especially in purulent exudate), aminoglycosides (gentamicin may not be as effective in a purulent exudate), and silver sulfadiazine (this is in a compound mixed with sterile saline. Recipes are available in several papers and textbooks). Some of these medications are contraindicated in the case of a tympanic membrane rupture, so please use caution when choosing a therapy especially if the status of the tympanic membrane is unknown. Short courses of systemic corticosteroids can be utilized to help decrease inflammation. Pain medications may also be considered as this is an extremely painful condition. Rechecks are necessary. Please do not stop treatment without reassessing the ear and cytology.

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