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Technical Note

Canine Otitis Externa and Its Clinical Management

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Abstract

Dogs and cats frequently experience otitis externa- an inflammation of the external ear canal. Head shaking, pain, foul odor, erythema, erosion, ulceration, swelling, and ceruminous gland inflammation are the symptoms that can occur. The diagnosis is based on clinical evaluation, otoscopic and cytological examinations, and culture for specific causes. The treatment will depend upon the specific etiology. Chronic or recurrent otitis externa is more difficult to treat than acute uncomplicated otitis externa. Recurrence, a common problem in otitis externa, can be prevented by addressing the inciting causes.

Keywords: Otitis Externa, Topical Medications, Yeast.

Introduction

In present day small animal practice, diseases of the ears of dogs and cats comprise a substantial fraction of patients reporting. Depending on the affected part of the organ, inflammatory conditions (otitis) are divided into external (Otitis externa), middle (Otitis media), and internal (Otitis interna). Inflammation of the external ear canal distal to the tympanic membrane is known as otitis externa. There may or may not be involvement of the ear pinna. Otitis externa can be unilateral or bilateral, acute or chronic, and persistent or recurrent. In reaction to persistent inflammation, the external ear canal may experience changes such as glandular hyperplasia, glandular dilatation, epithelial hyperplasia, and hyperkeratosis (Huang *et al.,* 2009). These changes typically lead to increased cerumen formation throughout the external ear canal, which raises the local pH and humidity levels and predisposes the ear to secondary infection.

Etiology

The etiology of otitis externa can be classified into causes and factors. The causes may be primary or secondary while factors can be predisposing and perpetuating factors. The factors usually contribute to or promote the disease by altering the physiology, structure, or function of the ear canal. While the perpetuating variables emerge as a result of the disease, predisposing factors exist prior to the onset of the disease.

Primary Causes: These causes create disease in a normal ear. They change the ear's environment, which frequently promotes the growth of a subsequent infection. The most frequent primary cause of canine otitis is underlying hypersensitivity disease (Saridomichelakis *et al.,* 2007). The primary causes are listed as follows.

- Allergy or hypersensitivity diseases: Food allergies, atopic dermatitis, contact hypersensitivity.
- Otic parasites:*Otodectes*, *Demodex*, *Sarcoptes*
- Endocrine disease: Hypothyroidism, hyperadrenocorticism)
- autoimmune/immune-mediated (pemphigus folliaceus, vasculitis, others)
- epithelialization disorders (sebaceous adenitis, zinc-responsive dermatitis)
- Otic Neoplasia
- Foreign bodies (grass awns, concreted wax, medications)
- Fungal: *Aspergillus*
- Viral: Distemper
- Miscellaneous: Proliferative necrotizing otitis of cats, juvenile cellulitis.

Secondary Causes: They create disease in an already diseased ear. These are often chronic or recurrent problems when the primary cause is not eliminated. The secondary causes include bacteria (*Staphylococcus, Streptococcus, Enterococcus, Pseudomonas, Proteus*), yeast *Malassezia*), medication reactions, and over-cleaning. *Staphylococcus* spp. is the most commonly isolated bacteria from the ear canals of dogs affected by otitis externa (Malayeri *et al.,* 2010). Some bacteria, like *Staphylococcus* and *Pseudomonas,* have the ability to produce biofilm. This biofilm must be broken for any antimicrobial therapy to be effective in eradicating the infection.

Perpetuating Factors: These are the factors that do not initiate inflammation but lead to exacerbation of the inflammatory process and maintain ear disease even if the primary factor has been identified and corrected**.** These factors include middle ear disease (usually otitis media), ear canal changes (stenosis, edema, and proliferative changes), rupture of the tympanum, and peri cartilaginous fibrosis or calcification. Although bacteria and yeast are usually classified as secondary causes, Staphylococcus, Pseudomonas, and Malassezia are considered common perpetuating factors (Bajwa 2019). Perpetuating factors are regarded as the main reason for treatment failure of recurrent otitis externa.

Predisposing Factors: These factors increase the risk of developing otitis externa by altering the local ear canal environment. These factors are usually congenital and environmental. Any factor that alters the microclimate of the ear canal can act as predisposing factors and include conformation (pendulous pinna, stenotic ear canal, hairy concave pinna, excessive hair in ear canal, increased cerumen production in ear canals), excessive moisture (environmental temperature and humidity, swimming), obstructive ear disease (neoplasia, polyp, feline apocrine cystadenomatosis), primary otitis media, systemic disease (immune suppression, catabolic states), and treatment

effects (trauma, frequent ear cleaning-changes the normal flora).

Clinical Findings and Diagnosis

The diagnosis is based on history, clinical examination, otoscopic examination, ear cytology, and sometimes advanced tests like CT scan and MRI. In general, the ear diseases are more common in dogs with pendulous ears (Lehner *et al.*, 2010), the predominant disease being external otitis (Terziev and Borissov 2018).

Clinical Examination and Otoscopic Examination: The clinical signs include any combination of head shaking, pain with ear manipulation, malodor, exudate, erythema, erosion, ulceration, swelling, or ceruminous gland hyperplasia. After a complete physical and dermatologic evaluation, the ears should be examined. Sometimes the painful cases may require sedation or systemic glucocorticoids for several days before an otoscopic evaluation is performed. Palpation of the pinna and ear canals will identify the presence of swelling, mineralization (due to chronicity), and pain. The presence of exudate, erythema, crusting, erosion, ulceration, lichenification, hyperpigmentation, and ulceration on the pinnae should be assessed. Surface cytology (yeast, bacteria, inflammatory cells), skin scrapes (Demodex, Sarcoptes), or dermatophyte culture may be used to sample the pinnae.

Otoscopic evaluation of the external ear canal and tympanic membrane is the first diagnostic procedure that should be performed in animals presented with otitis externa (Cole 2004). A handheld otoscope is typically sufficient for otoscopic evaluation and otoscopy should be performed on all dermatologic patients, if possible. Always use a clean and different cone for each ear. The canal should be evaluated for stenosis, erythema, erosions, hyperplasia, exudate, and masses. The tympanic membrane should be examined for changes in color, bulging, and rupture. However, the membrane is not often visible due to the presence of exudate in the horizontal canal, and cleaning may be required. Samples for cytology should be collected before any cleaning is performed. When there is excessive tissue proliferation or swelling, when the ear is painful, or when the canal is filled with exudate, it may not be possible to do an otoscopic examination of the vertical canals, horizontal canals, and tympanic membranes.

Ear Cytology: The cytological examination involves microscopic examination of exudate and ear scrapings. Exudate from the horizontal ear canal may be analyzed cytologically to provide quick diagnostic data. Most dogs and cats have tiny populations of commensal gram-positive cocci and yeast in their external ear canals. If the microenvironment is altered and promotes their overgrowth, these organisms may develop into pathogenic ones. A glass slide is used to roll exudate collected using a cotton-tipped applicator. The stained slide is examined under a microscope for the number and morphology of keratinocytes, leukocytes, and phagocytosis of microorganisms, bacteria, yeast, fungal hyphae, and acantholytic or cancerous cells. The presence of many neutrophils phagocytosing the bacteria demonstrates that the organisms are pathogenic.

The cocci-shaped bacteria are commonly staphylococci or streptococci while rod-shaped organisms are usually *Pseudomonas, Escherichia coli, Proteus mirabilis* (Fernández *et al.*, 2006). *Pseudomonas* (gram-negative rods) usually responds better to fluoroquinolones and aminoglycosides, so gram staining may prove beneficial, if *Pseudomonas* is suspected. Slimy green discharge, ulceration of the ear canal, and rods only on cytology is highly suggestive of *Pseudomonas* infection. Low levels of Malassezia can be seen in the healthy ears of dogs and cats, but they usually proliferate in otitis externa. In surface cytology samples taken from the affected ears, they are occasionally discovered on the surface of exfoliated squamous epithelial cells. Figures 1-3 show the ear cytology results of a few cases of otitis externa in dogs.

The ear exudate should be also checked for Otodectes cynotis and Demodex spp. (eggs, larvae, and adults). *Otodectes cynotis* in cats should be strongly suspected if there is dark, coffee-ground exudate. Cerumen and ear discharge are combined with a small amount of mineral oil to make smears on a glass slide. The smear is examined under low-power of microscope after applying a cover glass. Rarely, localised Demodex spp. proliferation in the external ear canals of dogs and cats may be related to refractory ceruminous otitis externa, and this part of the body may be the only one affected.

Chronic otitis externa results in nonspecific histopathologic alterations. A recommendation for intradermal allergy testing or for a trial of a hypoallergenic diet may be supported by histopathologic evidence of a

hypersensitivity response.

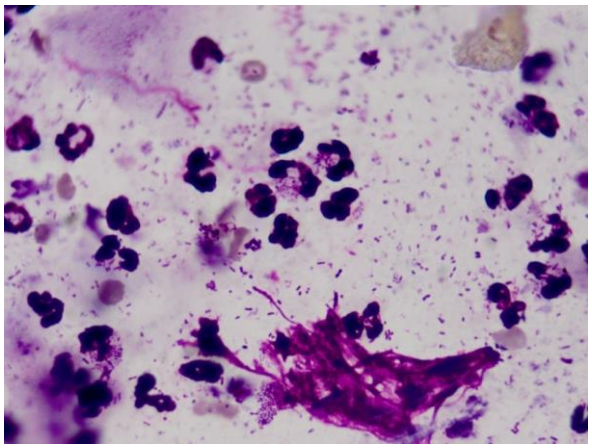

Fig 1: Stained ear swab smear (Leishman stain) showing large number of neutrophils with engulfed bacteria (both cocci and bacilli)

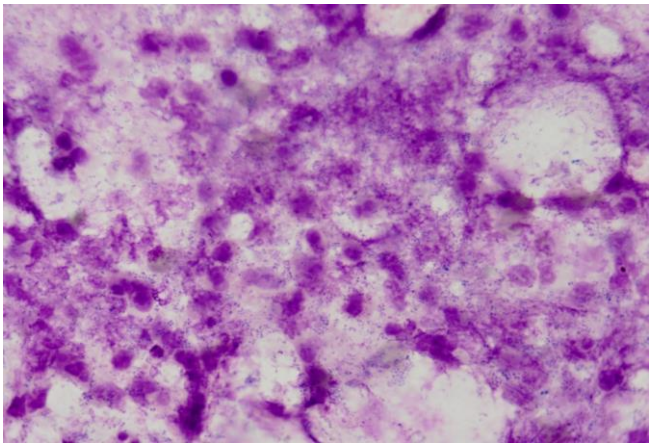

Fig 2: Stained ear swab smear (Leishman stain) suggestive of severe inflammation-large number of degenerated neutrophils and bacteria

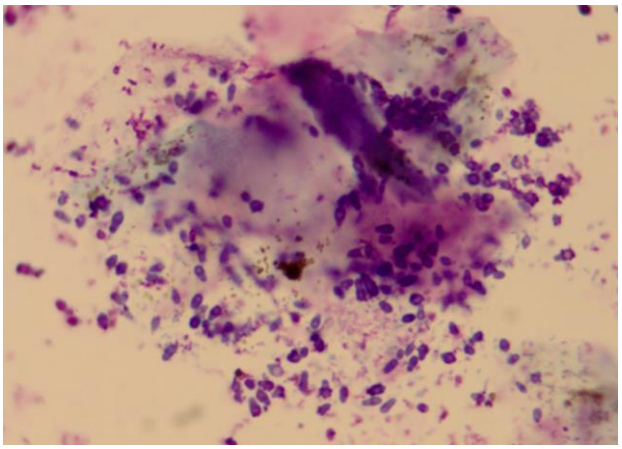

Fig 3: Stained ear swab smear (Leishman stain) suggestive of overgrowth of *Malassezia* organisms in the external ear

Additionally, biopsies from animals with unilateral, obstructive, chronic otitis externa may show the presence of neoplastic alterations. Biopsies are typically recommended when an ear tumour is blocking the ear canal. There may be additional clinical indications and signs in addition to those discovered in the ear if the main issue is an allergy, endocrine, or autoimmune illness.

Culture of Exudate: Even resistant bacteria frequently respond to topical therapy because the antibiotics are applied at much higher levels than those evaluated in susceptibility reports, making ear cultures unnecessary in most cases (Jacobson 2002). However, cultures should be performed in cases with suspected fungal etiology. The overall usefulness of culture and sensitivity in otitis externa is limited (Jacobson 2002). Many research groups

have studied culture and sensitivity characteristics (Baba *et al.*, 1981, Cole *et al.*, 1998; Kiss *et al.*, 1997; Guedeja *et al.*, 1998; Martin *et al.*, 2000), but the results (and, indeed, results from individual cases) are quite difficult to translate into definite treatment recommendations. Agreement between cytology and culture is not always good. The sensitivity of culture is inferior to that of cytology (Scott *et al.*, 2001).

Radiography: When proliferative tissues make it difficult to see the tympanic membrane clearly when otitis media is thought to be the source of relapsing bacterial otitis externa, and when neurologic symptoms are present with otitis externa, radiography of the osseous bullae is recommended. However, radiographs are normal in many otitis media instances. If adequate treatment is ineffective for severe, chronic otitis, a CT scan or magnetic resonance imaging, if available, should be done. If otitis media is suspected in addition to otitis externa, CT or MRI can be useful to decide whether a myringotomy and middle ear flush is needed.

Management of Otitis Externa

The treatment of otitis is tailored to each individual case (Rosychuk and Luttgen 2000). The successful treatment involves many different aspects and ought to follow these steps (Chester 1988; Griffin 1993; Greene 1998; McKeever and Torres 1997; Rosychuk1994; Scott *et al.*, 2001):

1. Determine the root cause of the otitis and treat it.
2. Irrigate the ear canal to remove the exudate, and management of inflammation.
3. Identify concurrent otitis media and treat it
4. Based on the findings of the culture, choose an appropriate antibiotic and use it for the necessary amount of time. Administer both topically and internally till the infection is treated.

The cornerstone of treatment for otitis externa is a topical medication, while some patients may also benefit from systemic anti-inflammatory and/or antibacterial therapy. Whatever the underlying reason of their otitis, most dogs will benefit from anti-inflammatory treatment. For a brief period of time, glucocorticoids can assist in reducing discomfort and swelling, which helps with better compliance for ear cleaning and drug delivery. Prednisone and triamcinolone are used most commonly, with duration and dose depending on the severity and chronicity of disease. Additionally, glucocorticoids can hinder the growth of biofilms and stop the onset of chronic otic alterations. It is not recommended to treat otic illness with lengthy regimens or glucocorticoid dependence unless absolutely essential. Systemic antibiotic therapy is typically not recommended for the treatment of otitis externa.

Ear hygiene is crucial, so hair from the pre-and periauricular region, as well as hair from the medial surface of the pinnae and the tips of the pinnae, should all be clipped. This makes it easier to clean and treat the ears. Although controversial, hair removal from the ear canal may be necessary to effectively treat the ear infection.

It is recommended to frequently reevaluate the patient's receiving treatment for otitis externa, including otic cytology, to see if any treatment modifications are required. In order to make sure perpetuating or main factors are not present when therapy is finished, a follow-up evaluation that includes palpation, otoscopic examination, and ear canal cytology is quite beneficial. If the issue reappears despite the otitis being shown to have resolved, it is necessary to thoroughly examine any potential underlying primary diseases as well as contributing and perpetuating factors.

The cleaner may be uncomfortable to some animals when pressed straight into the ear canal. This discomfort is overcome by using cotton balls soaked in cleanser. They can be placed at the ear canal's opening (while still being removable), the ear canal is massaged, and the cotton ball is then taken out. Repeat this process up until the cotton ball is clean or visible blood appears (indicating irritation).

Cleaning of infected ears with a ceruminolytic solution such as carbamide peroxide or dioctyl sodium sulfosuccinate (DSS), two to three times a week may be necessary if the material in the ears is thick, dry, or waxy. It may be necessary to clean infected ears with profuse purulent discharge once or twice a day. Squalene should be present in the ear cleaner if rods are present since Pseudomonas is one possible cause and it has the ability to create a biofilm that shields bacteria from antibiotics. To get rid of leftover ear cleanser, thoroughly rinse the ears with warm water. Detergents and DSS are contraindicated if the tympanic membrane have ruptured; instead, milder cleaners (such as saline, saline + povidone iodine, or Tris EDTA) should be used to flush the ear.

Effective treatment may also call for systemic and topical antibacterial and anti-inflammatory therapy in addition to cleansing. Depending on the condition, the course of treatment may last anywhere from 7 to 10 days to several months. Topical antibacterial drugs combined with corticosteroids minimise exudation, discomfort, swelling, and glandular secretions in the treatment of acute bacterial otitis externa. The least potency corticosteroid that will reduce inflammation should be used. Most dogs only need 1 mL of medication, however larger-eared dogs may need up to 2-3 ml. This volume must be infused twice day at the very least for the treatment to be effective. In an ear that is already inflamed, substances that ordinarily do not irritate the ear canal may do so, particularly in the case of propylene glycol. Powders like those used after removing hair from the canal shouldn't be utilised since they can cause uncomfortable concretions inside the ear canal.

Both acute and chronic otitis externa frequently require the use of systemic glucocorticoids to treat discomfort, edoema, and inflammation. Moreover, glucocorticoids lessen the quantity of purulent discharge, which enhances the efficiency of aminoglycosides (the most common antibiotics in ear medications). Dogs with chronic, highly stenotic ears may need to take prednisone doses of 2 mg/kg/day for two weeks before tapering off. This large dose increases the likelihood that the ear can be managed medically rather than necessitating a surgical procedure like complete ear canal ablation. It is necessary to properly manage the underlying condition and any secondary infections because this dose cannot be sustained over the long term.

In cases of otitis externa, systemic antibiotics are not necessary, but they must be used if otitis media is suspected. Because many gram-negative rods are resistant to common first-tier dermatologic antibiotics like cephalexin, the use of systemic antibiotic must be based on cytology. The majority of instances of otitis externa with yeast respond well to topical medication, however systemic antifungals such terbinafine for dogs and cats or ketoconazole for dogs may be beneficial. When myringotomy is performed it creates an opening into the middle ear, topical ear medicine is applied in quantities sufficient to reach the middle ear. Middle ear flushing followed by a lot of topical ear medicine is more efficient than only delivering systemic antibiotics for both bacterial and fungal middle ear infections. If antibiotics are administered systemically, they will only reach the middle ear's lining and not its lumen, which increases the risk of developing antibiotic resistance.

The treatment duration will depend on the individual case but should continue until the infection is cured based on re-examination and repeat cytology. The cases with bacterial or yeast infections should be examined (physically and cytologically) weekly or every 15 days until there is no sign of infection. This takes 2-4 weeks for the majority of acute cases. Chronic conditions can take months to get well, and in some circumstances, a maintenance treatment needs to go on forever. Evaluation for otitis media should be taken into consideration if cases of otitis externa do not improve after treating underlying problems, using the right therapy, and getting owner cooperation.

*The best treatment for chronic otitis is prevention***.** Topical and, in rare circumstances, systemic medications should be selected based on the history and cytology in addition to determining the cause of acute otitis; they should have a narrow spectrum and be particular to the current condition, taking into account which medications have already been used to treat the current infection. First, neomycin should be used. Aminoglycosides and fluoroquinolone antibiotics are the most often found components in topical otic medicines, although they should only be used when absolutely necessary for effective therapy. The owner should be instructed on proper use (frequency and duration) because many topical solutions contain a mixture of glucocorticoids, antibiotics, and antifungal drugs. When the ear "looks better," many owners stop the medication before the infection is healed. Antibiotics like polymyxin B and fluoroquinolones have proven the most effective at treating Pseudomonas infections when resistance has been identified through failure to show a clinical response. Fluoroquinolones are rapidly acquiring resistance due to needless use, so according to ethical antibiotic stewardship standards, they should only be administered as a last resort.

Contribution by Authors

Equal contribution

Conflict of Interests

There is no conflict of interest.

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