

Otitis: The Complete Diagnosis

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Otitis cases are often complex and involve more than one etiologic component. This means the diagnosis and management of otitis externa is often much more complex than just recognizing what “caused” the ear disease. A successful approach to ear disease requires the understanding of what really is contributing to the pathology of any given ear, which requires that each component of the problem ear be recognized. The PSPP classification considers the etiologies as causes, which are diseases, or agents that directly produce inflammation in the ear and are Primary and Secondary. Factors are agents or elements of the disease or pet that contribute to ear disease and are divided into Perpetuating and Predisposing. For each cause or factor there is a prognosis, methods for assessing or monitoring as well as treatment options. The classification has been combined with prognostic labels, some educational diagrams, a table (Table 1) into a handout the PSPP System© which may be used to help organize a diagnostic plan, complete diagnosis, prognosis, treatment plan and educate the client. See attached PDF and it is also available to download at www.animaldermatology.com.

Table 1 from PSPP system©

Name	Date	Determine and Assess	Treatment T / S AB/AF/GC/EC/AllRx/D/Ot		
Causes and Factors Identified		Cyt/Oto/CR/Ot	C	LTM	LLRx
Primary					
Secondary					
Perpetuating Factors					
Predisposing Factors					

It is important to establish if a dog with chronic otitis hears. First this often changes my approach to a case. If hearing loss seems permanent and non reversible then total ear canal ablations and bulla osteotomy become better treatment options. Hearing loss is the main side effect of the procedure and if this were not an issue I would spend less time and expense trying medical therapy. In addition hearing needs to be determined prior to ear flushing and medicating with topical medications when otitis media is likely. It always surprises me how often dogs have fairly apparent hearing loss or deafness and owners are not aware of it. This is especially common when there are multiple pets in the household. It is important to ask questions about response to doors, cars pulling up, being called when outside and localizing the sound, sound sleeping and anything else that will help determine if there is significant hearing loss. Sounds should be made in the exam room when the dog is not paying attention to the veterinarian. It is important to not just see the dog responded to the sound but did it localize where the sound was coming from almost immediately. A problem may occur if a near deaf or deaf dog is not recognized in the examination and then the owner is warned about deafness as a side effect to the deep ear flush and treatment being sent home. After the procedure the client pays attention and recognizes there dog does not hear well then blames the treatment when in fact the dog had been deaf prior to the treatment. Brainstem auditory evoked response (BAER) testing is a more accurate way of assessing the dogs hearing. This allows one to assess hearing threshold, the level of sound that each ear detects and stimulates a brain response. It is being used to assess hearing loss and ototoxicity. Unfortunately it is not readily available.

Primary causes

Primary causes are usually the actual inciting agent or etiology that directly causes damage or inflammation to the ear canal skin. These can occur alone and induce otitis externa without any other cause or factor. The primary cause may be very subtle and often go unrecognized by the owner or even veterinarian until a secondary cause occurs. Once a primary etiology alters the aural environment secondary infections often develop. In the authors opinion the vast majority of cases will have a primary cause though they may not always be readily apparent. Idiopathic or not diagnosed was reported in 32 of 100 cases.^[1] In general practice foreign bodies and ear mites make up a significant number of cases and once they occur they may result in perpetuating factors that result in chronic ear

disease. If not seen early in the process they may then present without the primary cause being readily diagnosed. That and atopic otitis without obvious skin disease likely are responsible for many of these cases called idiopathic or not diagnosed. Some of these may also occur when predisposing factors combine with secondary causes, but it is likely most of these cases have a primary cause that was unrecognized. The most common causes seen in a dermatology referral practice are atopic disease, food allergy, epithelialization or metabolic disorders. In general practice foreign bodies and ear mites are relatively more prevalent. It is critical too successful long-term management that a primary cause be found and either eliminated or control be secured. The diagnosis of the primary cause often is determined from the otoscopic exam, cytology, complete dermatologic history and examination as well as diet or therapeutic trials, and possible organ testing or biopsy of the skin in other areas or the external ear.

Secondary causes

The secondary causes do not create disease in a normal ear; they contribute to or cause pathology only in the abnormal ear. As such they occur in combination with primary causes or predisposing factors. Generally secondary causes of otitis externa are easy to eliminate once identified and when they are chronic or recurrent it is usually because primary causes or perpetuating factors have not been adequately addressed. Secondary causes in the past were often considered as primary causes or the “main” diagnosis of an ear case. (ie. *Pseudomonas* or *Malassezia* otitis) Even today many clinicians direct all their efforts at diagnosing and treatment of secondary causes. Although their treatment may be important, other causes and factors must be looked for. In some cases such as *Malassezia*, eliminating the concurrent predisposing factor or primary disease may result in the resolution of the secondary problem. Secondary causes are most often diagnosed with cytologic examination and culture and sensitivity testing when indicated.

A more recently recognized concern in otitis cases is the presence of biofilms. Biofilms are a community of bacteria that live in an extracellular polymeric matrix that increases resistance to antibiotics and host defense mechanisms. Biofilms are different than the planktonic or individual cells of bacteria that are what is most commonly studied when evaluating infectious diseases that fulfill Koch’s postulates. The extracellular matrix is composed of polysaccharides, DNA and proteins and is often referred to as SLIME, a physical characteristic that is associated with some biofilms seen in nature. These communities, originally associated with adhesion to solid surfaces, are known to occur in aggregates in some tissues.[2] The tissue aggregate form may further enhance mechanisms of survival in the affected tissue.[3, 4] The slime may also contribute to damage of the tissue and pathologic responses that occur. The biofilm increases resistance to antimicrobial agents by more than producing SLIME. In addition metabolic adaptations occur at a higher frequency in biofilms and the communities stimulate the development of persister cells. Persister cells are slow growing and do not grow in the presence of an antibiotic. They persist and are able to grow again once the antibiotic is gone. These biofilm infections are most often associated with chronic diseases and in humans middle ear and possible the external ear are sites of predilection.[5, 6] Forty percent of canine otitis strains of Staph. intermedius and Pseudomonas are capable of producing the extracellular polymeric substance of biofilms.[7, 8] Malassezia may also form biofilms.[9] So far biofilms have not been documented in canine otitis cases by two of the best methods for detecting biofilm infections, peptide nucleic acid-fluorescent in situ hybridization (PNA-FISH) and confocal laser scanning microscopy (CLSM). However I have seen cases that have aggregates present on cytologic examination of ear exudate. Seeing these three dimensional aggregates is suggestive and in humans the otitis media aggregates vary from 4-80 uM.[4]

Culture and sensitivity is not routinely recommended and should never be done without cytology. A culture is typically only done if systemic therapy is being prescribed. It has been shown that response to topical therapy does not correlated with culture results.[10] If the cytology reveals suppurative inflammation with relatively pure populations of rods or cocci and the animal has not responded to appropriate topical and systemic antibiotic then a culture and sensitivity may be indicated. The lab should also be sent a cytology slide and any information regarding the organisms seen at time of collection so they know if multiple organisms should be identified.

Perpetuating factors

Perpetuating factors are changes in the anatomy and physiology of the ear that occur in response to otitis externa, they occur after ear disease. These factors may be subtle at first but over time can develop into the most severe component of chronic ear disease. These factors are not disease specific and are most commonly seen in chronic cases. Once present, they accentuate or permit the development of secondary causes by providing environments and microscopic niches that favor their persistence. In many cases perpetuating factors prevent the resolution of otitis externa when treatments are only directed at primary and secondary causes. They cause much frustration to clinicians for several reasons. They often result in animals presenting repetitively with different causes present at each subsequent visit. These factors can become self-perpetuating and lead to progressive worsening of disease. They can become severe and end up causing the majority of symptoms exhibited by a pet or be so mild appearing that to many veterinarians as well as owners a pet and its ear canal appear normal. Yet left untreated perpetuating factors, even though primary and secondary causes are controlled or eliminated, result in recrudescence of clinical disease.

In chronic cases often more than one of these factors will be present. Standard treatments of the primary and secondary diseases present often times will not immediately eliminate the perpetuating factors. In early cases, treating the primary cause may be

sufficient in controlling a case, but after the establishment of perpetuating factors treatment may need to be directed at them. The treatment for perpetuating factors is often different that what is required to control primary and secondary causes of otitis externa. Their treatment should be continued until they have resolved which may take months of continuous therapy and in some cases they are permanent and will require life long therapy or a surgical solution.

Perpetuating factors are the most common reasons otitis externa cases require surgery. Perpetuating factors are diagnosed otoscopic examination; repetitive otoscopic examination timed appropriately, tube palpation and other imaging techniques (radiology, CT scans, MRI).

Diagnosis of otitis media can be made when a ruptured tympanic membrane is seen. A technique of tube palpation and flushing can aid in the diagnosis of otitis media. This technique also may reveal false middle ear cavities. The method is greatly enhanced with FOVEO and the ear canal filled with water, which increases magnification by 4/3 thus appearing 25% larger. Also air bubble may be seen coming through some small tears. The soft tube can be used to palpate any material located at the approximate level of the tympanic membrane. Both depth of the canal and location of the tip of the tube are utilized to determine if a false middle ear or otitis media is present. The feeding tube is passed under visualization with a surgical otoscope head down the ear canal to the level where the tympanic membrane is expected to be located.

Predisposing factors

Predisposing factors are present prior to the development of ear disease but alone do not cause otitis externa. They increase the risk of development. These factors work in conjunction with either primary causes or secondary causes to become a significant problem. In rare cases a predisposing factor may combine with a secondary cause to create disease even when no primary cause is present. The best example of this is a dog that gets water in its ear that leads to epidermal maceration or damage and then a secondary bacterial or yeast infection occurs. It is possible this is how environment, increased heat and humidity, also contribute to otitis. However in the authors experience these animals often do have a subtle but mild primary disease still present but controlling that disease does not appear to be necessary. Some predisposing factors relate to the normal anatomy of the dog and as such are not something that is cureable unless surgery may alleviate it, such as a stenotic external orifice in a Chinese shar pei. Pendulous pinnae have been shown to be a statistically significant predisposing factor for otitis externa though no studies have adjusted for this finding based on the presence of breed predisposition to other primary causes of otitis[11].

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