CAUSES
Primary Factors
Most ear diseases have a primary trigger that is the inciting factor. These include:
• In most cases, allergies, such as food and/or environmental allergies
• Ectoparasites
• Endocrine disease
• Autoimmune disease
• Foreign materials
• Neoplasia
• Keratinization disorders.

Predisposing Factors
Predisposing factors that contribute to disease, but do not cause it, include:
• Conformational problems, such as spaniels with floppy ear pinnae or shar-pees with stenotic canals
• Lifestyle, such as dogs that swim.

Perpetuating Factors
Perpetuating factors enable the disease process once it is established and include:
• Infectious organisms, such as yeast and bacteria
• Chronic changes, including hyperplasia, stenosis, and otitis media.

HISTORY & PHYSICAL EXAMINATION
It is important to take a detailed clinical history and perform both a physical and dermatologic examination in order to start the process of diagnosing ear disease.

These steps can help determine contributing factors and allow the clinician to formulate a logical diagnostic plan. Examples include:
• If allergy is considered a primary factor, the institution of an elimination diet trial should be considered prior to possible allergy testing.
• In middle-aged or senior dogs with otitis externa and no previous history of ear disease, systemic triggers should be considered. Routine health profiles and endocrine function tests may be useful.
• If a dog is presented for unilateral otitis, neoplasia or foreign material should be investigated prior to considering other causes.

OTOSCOPIC EXAMINATION
Otoscopic examination is the method of choice to evaluate the external ear canal and may also assist with identification of an existing otitis media. Diagnostic samples should be taken from the pinna, ear canal and, when otitis media is present or suspected, the middle ear. Any discharge from the ear should also be collected and evaluated.
**DiagnosTic aPProach To oTiTis in Dogs**

**Ear Canal Assessment**

Before otoscopic examination is performed, the clinician should assess the ear canal for chronic change. Calcification of the canals and a reduction in the lumen due to chronic disease can be determined by palpation and help the clinician determine the appropriateness of medical or surgical intervention. If the canal is deemed irreversibly damaged; then the patient may be redirected for surgery.

**Ear Canal Anatomy**

In order to perform a good otoscopic examination and take appropriate samples from the ear, the clinician should be well acquainted with the anatomy of the normal ear canal and tympanic membrane (Figure 1). In addition, because otitis media is often present and/or recognized as a common cause in cases of chronic otitis externa, it is important to learn how to recognize the presence of otitis media.

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**Table 1.**

<table>
<thead>
<tr>
<th>Primary Lesions</th>
<th>Secondary Lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comedones</td>
<td>Crusts</td>
</tr>
<tr>
<td>Erythema</td>
<td>Excoriations</td>
</tr>
<tr>
<td>Papules</td>
<td>Hyperpigmentation</td>
</tr>
<tr>
<td>Pustules</td>
<td>Lichenification</td>
</tr>
<tr>
<td>Ulcers</td>
<td>Scales</td>
</tr>
</tbody>
</table>

**SAMPLE COLLECTION & EXAMINATION: PINNA**

Many primary triggers for otitis first present with signs on the pinna. A careful inspection can identify primary lesions (Figure 2) and secondary lesions (Table 1); secondary lesions tend to be less useful diagnostically. A minimum data base for the pinna should include:

- Cytology (impression smears and tape preparations)
- Superficial and deep skin scrapings
- Trichograms
- Bacterial and fungal culture
- Fine-needle aspirates
- Biopsy.

The type of lesion best suited to each of these diagnostic techniques is listed in Table 2. The reader is referred to more detailed dermatologic texts for precise descriptions of sample collection.

**SAMPLE COLLECTION & EXAMINATION: WALL OF THE CANAL**

When lesions are present on the ear canal wall, samples should be taken directly from those lesions whenever possible. Impression smears, fine-needle aspirates, and biopsies can be taken from this site.

- **Impression smears** can be taken from ulcerative lesions by rolling a cotton swab firmly along the wall of the canal. The swab is then rolled on a glass slide, heat fixed, and stained.
- **Fine-needle aspirates** can be obtained when nodular lesions are present within the canal. Fine-needle aspiration is achieved by:
  1. Using a long needle inserted down the working...
channel of a video otoscope (needles are supplied by the video otoscope manufacturer) or
2. Using a long spinal needle inserted alongside a
video or handheld otoscope (Figure 3).

The needle is inserted into the mass while suction is applied; then repositioned in the mass, allowing several aspirations to collect material before being withdrawn (suction is maintained throughout the process). The needle is then detached and the contents of the syringe expelled onto a slide, stained, and examined.

- Biopsies can be accomplished by using a laser or may be removed by traction from the canal wall using a pair of long crocodile forceps.

SAMPLE COLLECTION & EVALUATION: MIDDLE EAR

Key points in the dog’s history and physical examination should give the clinician a high level of suspicion if otitis media is present.

History: Clues from the history may include reluctance to:
- Open the mouth
- Chew hard food
- Carry a bone
- Bark.

Physical Examination: The physical examination may reveal signs of cranial nerve damage, such as:
- Facial nerve damage (due to damage to motor nerve function) leading to facial asymmetry
- Keratoconjunctivitis sicca associated with parasympathetic fiber damage.

Tympanic Membrane

When the tympanic membrane is abnormal or ruptured, the chance of otitis media is very high. However, an intact and apparent normal tympanic membrane does not completely rule out otitis media, in which case diagnostic imaging, such as computed tomography (CT) or magnetic resonance imaging (MRI), may be indicated (see Imaging, page 31).

The normal tympanic membrane should be thin, pale grey, and translucent (Figure 1). Abnormalities may be associated with bulging of the membrane, which can be seen when fluid is present within the middle ear. These abnormalities are typical of otitis media and often present in cases of canine primary secretory otitis media, which is seen in Cavalier King Charles spaniels (Figure 4).

On occasion, the tympanic membrane can be retracted inwards, suggesting negative pressure within the middle ear. A good light source allows visualization of hemorrhage or purulent discharge behind the membrane.

Myringotomy

When the tympanic membrane is abnormal but intact, a myringotomy under general anesthesia should be

Table 2.

<table>
<thead>
<tr>
<th>Primary Lesion</th>
<th>Diagnostic Tests</th>
<th>Most Common Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comedone</td>
<td>Biopsy - Deep skin scrapes - Fungal culture - Trichogram</td>
<td>Demodex canis - Dermatophytosis - Hyperadrenocorticism - Hypothyroidism</td>
</tr>
<tr>
<td>Crust &amp; Scale</td>
<td>Cytology - Deep skin scrapes - Fungal culture</td>
<td>Demodex cornei - Dermatophytosis - Malassezia pachydermatis - Sarcoptes scabiei</td>
</tr>
<tr>
<td>Nodules or Plaque</td>
<td>Biopsy - Fine-needle aspirate - Tissue culture</td>
<td>Hyperplastic disease - Infectious nodular disease - Neoplasia</td>
</tr>
<tr>
<td>Papule</td>
<td>Bacterial culture - Cytology - Deep skin scrapes</td>
<td>Cheyletiella species - Ectoparasites (ie, Sarcoptes scabiei) - Notoedres cati - Otodectes cynotis</td>
</tr>
<tr>
<td>Pustule</td>
<td>Bacterial culture - Biopsy - Cytology</td>
<td>Infection (ie, Staphylococcus pseudointermedius) - Sterile pustular disease (ie, pemphigus foliaceus)</td>
</tr>
<tr>
<td>Ulcer</td>
<td>Biopsy - Impression smear</td>
<td>Contact allergy/irritant - Immune-mediated disease (ie, vasculitis)</td>
</tr>
</tbody>
</table>
performed. This useful technique should only be performed by an experienced clinician and is difficult to accomplish safely without the use of a video otoscope.

- A 6 French gauge catheter (with the end cut off at a 45-degree angle) is carefully inserted through the tympanic membrane at the 5 to 7 o’clock position within the pars tensa, which avoids important structures, such as the malleus and the pars flaccida (labelled in Figure 1).
- A sterile syringe is attached to the catheter and the plunger gently withdrawn to remove fluid from the tympanic bulla.
- If fluid cannot be withdrawn, then 0.5 to 1 mL of sterile saline can be instilled into the bulla and then aspirated.
- Samples can be examined to determine cytologic findings. However, culture is generally accepted as being more sensitive than cytology for the middle ear; therefore, culture samples should be collected during myringotomy.

**Guarded Swab**

If the tympanic membrane is ruptured, a guarded swab (Figure 5) can be used to collect samples for cytology and culture.

- This is achieved by inserting a fine sterile cotton swab down an otoscope cone to facilitate sample collection from deep within the canal. The otoscope cone protects the swab from organisms within the vertical canal.
- The swab should be rolled onto 2 glass slides for microscopic examination. One slide should be examined unstained while the other should be stained with a modified Wright’s stain, such as Diff Quik, and then examined under low and high power and under oil immersion lenses.
- When indicated by cytologic findings, a sterile swab may be submitted for culture and sensitivity (see CSI: Culture, Sensitivity, Identification).

**Examination**

A catheter can be introduced into the middle ear through a ruptured tympanic membrane or via myringotomy and used to palpate the wall of the middle ear. The catheter can be bounced off the walls of the tympanic bulla to assess whether the bulla is air filled (if the catheter bounces off solid bone) or contains soft springy granulation tissue. If the bulla contains granulation tissue, advanced diagnostic techniques may be needed to visualize the middle ear.

**SAMPLE COLLECTION & EVALUATION: DISCHARGE**

**Cytology**

Cytologic examination of discharge from ears should be a routine part of every ear examination. Both ears should be sampled even if only 1 ear is affected in order to identify any initial asymptomatic ear infection.

Cytologic samples can be collected from the lumen of the canal using a cotton swab.

- The swab should be inserted into the canal, rotated, and withdrawn.
- Bacteria present in the external canal may not be representative of the bacteria present in the middle ear; therefore, separate cultures may be needed when otitis media is suspected or confirmed.
- Once samples have been collected, microscopic examination will help determine the organisms or disease present (Table 3).

**Ectoparasites**

Collecting samples for ectoparasite identification, such as *otodectes* and *demodex* mites, can also be performed. Wax can be collected by wiping a cotton wool swab along the wall of the canal; then rolling it along a slide. No staining is needed. If there is a large amount of wax, the sample may be cleared by using 10% potassium hydroxide.
**IMAGING**

Diagnostic imaging techniques, such as radiography, CT, or MRI, should be considered if otitis media is thought to be present in order to confirm diagnosis and assist with prognosis and treatment recommendations.

Radiography can be performed but is an insensitive technique—otitis media can still be present in the face of normal radiographic findings. If radiography is performed, the 3 most common views are:

- **Dorsoventral**: This view can be used with or without contrast to visualize the external ear canals. The bullae are superimposed on the soft tissue of the skull and the petrous temporal bones, making assessment of fine detail difficult.
- **Rostrocaudal** (open mouthed): An open-

<table>
<thead>
<tr>
<th>Microscopic Finding</th>
<th>Description</th>
<th>Diagnostic Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CYTOLOGY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coccis</td>
<td></td>
<td>Enterococcus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Staphylococcus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Streptococcus</td>
</tr>
<tr>
<td>Rods</td>
<td></td>
<td>Coliforms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proteus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pseudomonas (Figure 6)</td>
</tr>
<tr>
<td>Inflammatory Cells</td>
<td>Degenerate neutrophils + proteinaceous debris</td>
<td>Acute disease (often accompanied by nucleated epithelial cells and bacteria)</td>
</tr>
<tr>
<td></td>
<td>Degenerate neutrophils &amp; macrophages + proteinaceous debris</td>
<td>Chronic disease (often accompanied by nucleated epithelial cells and bacteria)</td>
</tr>
<tr>
<td>Keratinocytes</td>
<td>Large anucleate epithelial cells (may be flat or rolled, with or without stain) <em>(Figure 7)</em></td>
<td>Normal finding</td>
</tr>
<tr>
<td></td>
<td>Large anucleate or nucleated epithelial cells + debris</td>
<td>Nonspecific finding</td>
</tr>
<tr>
<td></td>
<td>Rounded nucleate cells with nondegenerate neutrophils</td>
<td>Autoimmune skin disease, especially pemphigus foliaceus</td>
</tr>
<tr>
<td>Yeast</td>
<td>Peanut shaped</td>
<td>Malassezia pachydermatis <em>(Figure 8)</em></td>
</tr>
<tr>
<td><strong>ECTOPARASITES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mites</td>
<td>Long cigar-shaped mite; adult has 8 legs</td>
<td>Demodex canis</td>
</tr>
<tr>
<td></td>
<td>Large oval-shaped mite; adult has 8 legs</td>
<td>Otodectes cynotis</td>
</tr>
</tbody>
</table>

*Figure 6. Ear cytology from a case of Pseudomonas otitis showing neutrophilic infiltrate with rods*  
*Figure 7. Ear cytology from a normal ear showing some anucleate epithelial cells and proteinaceous debris*  
*Figure 8. Ear cytology from an ear infected with Malassezia species*
mouthed view allows good visualization of both tympanic bullae.

- **Lateral oblique**: This view highlights the tympanic bulla, which should appear as a thin-walled crisply outlined structure; however, this technique does not allow comparison with the other bulla.

Both CT and MRI provide excellent visualization of the middle ear and are highly preferable to radiography; however, their use is mostly confined to referral centers. CT is particularly useful for assessment of the middle ear (Figure 9).

**ADDITIONAL DIAGNOSTICS**

Brainstem-evoked auditory responses are employed by some hospitals to measure hearing in dogs with otitis. When available, this modality can be useful for prognosis when a clinician is assessing an ear to decide if it is irreversibly damaged and, therefore, unable to be treated with medical therapy.

**REFERRAL**

As this article outlines, there are a multitude of diagnostic modalities available to the practitioner when it comes to diagnosing otitis. In some cases, referring a patient to a specialist in ear disease or veterinary hospital with advanced imaging techniques, will allow diagnosis in more difficult cases. Visit the American College of Veterinary Dermatology’s website (acvd.org) for a list of board-certified veterinary dermatologists.

CT = computed tomography; MRI = magnetic resonance imaging

**Suggested Reading**


**Figure 9.** CT image of cat’s ears. The normal appearance of the black air-filled tympanic bulla is partially lost due to the pale soft-tissue densities within the bulla. These changes are consistent with the presence of granulation tissue due to chronic otitis media.

**EAR CLEANING 101: CANALS & TYMPANIC MEMBRANES**

Appropriate ear cleaning maximizes the benefits of topical therapy.

- Ceruminolytic cleaners are advantageous when a thick ceruminous discharge is present. Squalene is an excellent, safe cleaner for use in circumstances where the tympanic membrane cannot be visualized.
- Dioctyl sodium succinate and carbamide peroxide are equally effective ceruminolytics if the tympanic membrane can be seen and is intact.
- Water, sterile saline, or dilute chlorhexidine (< 0.2%) can be used to flush the ear canal if a purulent rather than a waxy discharge is present.

Copious amounts of fluid may be instilled in the ear and suctioned out to remove discharge and allow visualization of the canal and tympanic membrane. All 3 solutions are safe to use even if the tympanic membrane is ruptured.

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