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## Abstract

Ear disease in small animals can be very frustrating for owners—and veterinary healthcare teams—to manage. To manage ear disease, the veterinary team must be familiar with ear anatomy and the causes of ear disease. This article will cover basic anatomy of the ear, signalment, clinical signs, sample collection, stages of ear disease, diagnosis, cleaning, and treatment options. A basic understanding of ear disease will allow the veterinary nurse to communicate better with clients about how treatments are performed and define the expectations of managing ear disease.

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## DERMATOLOGY

# Ear Disease in Canine Patients

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**E**ar disease is seen in 7% to 16% of canine cases in veterinary hospitals.<sup>1</sup> There is a wide range of clinical signs and severity, and every case is unique to that patient. Because of these factors, ear disease can be very frustrating, not only to pet owners but also the veterinary team. It is a time-consuming disease that can sometimes seem futile. Ear disease treatment can be approached several ways, but the end goal is always the same: Eliminate the need for surgical intervention.

## ANATOMY AND STRUCTURE

The purpose of the ear pinna and canal is to funnel sound waves to the tympanic membrane and inner ear (**FIGURE 1**).<sup>1,2</sup> The ear canal is an L-shaped structure made up of the vertical and horizontal canal. This structure should be pliable on palpation and feel like a milkshake straw—firm but easily compressible.<sup>1,2</sup> The junction of the vertical and horizontal canals creates a protrusion that can be very sensitive.<sup>1</sup> Care must be taken to not bump or otherwise irritate this area. On

### Take-Home Points

- Ear disease is seen in 7% to 16% of canine cases in private practice.
- Ear disease can happen at any age and involve various causes and factors.
- Clinical signs of an ear infection include head shaking, ear scratching, odor, exudate, erythema, stenosis, head tilt, odd ear carriage, and hot spots on the cheek.
- Collecting ear samples too aggressively can create inflammation in an already friable ear and possibly cause an ulcer.
- In the early stage of ear disease, the canal is still pliable and infections are infrequent.
- Chronic ear disease causes a decrease in pliability of the canal with mild stenosis and erythema; middle ear involvement is likely.
- End-stage ear disease typically results from years of chronic infection, with partial calcification and completely stenotic canals.
- Cleaning techniques include the “pour” technique, which involves filling the canal with cleaner, and the “cotton ball” technique, in which a cotton ball is soaked with cleaner and inserted into the canal. With either technique, the canal is then massaged.
- Cleaning should be done depending on risk: as needed for normal dogs, weekly for those with skin disease or allergies, and once to twice a month for at-risk patients.
- The best procedure for medical management of chronic ears with otitis media is a computed tomography scan followed by a myringotomy and bulla flush.

otoscopic examination, the ear canals should be circular, smooth, have some blood vessels, and end in a somewhat circular tympanic membrane.

The tympanic membrane (**FIGURES 2 AND 3**) is a thin piece of tissue that separates the external canal from the middle ear and is made up the pars flaccida and the pars tensa. The pars flaccida is the upper loose portion of the tympanic membrane that supplies blood to the bottom portion. The pars tensa is the tightly stretched lower portion that transfers sounds waves.<sup>1</sup> The manubrium is the white bony structure located at the junction of the 2 sections; it is the head of the malleus and transfers sound waves to the incus and stapes.<sup>1</sup>

The middle ear is composed of the tympanic bulla and the auditory ossicles (malleus, incus, and stapes). The bulla is a smooth, ball-shaped, hollow bony structure

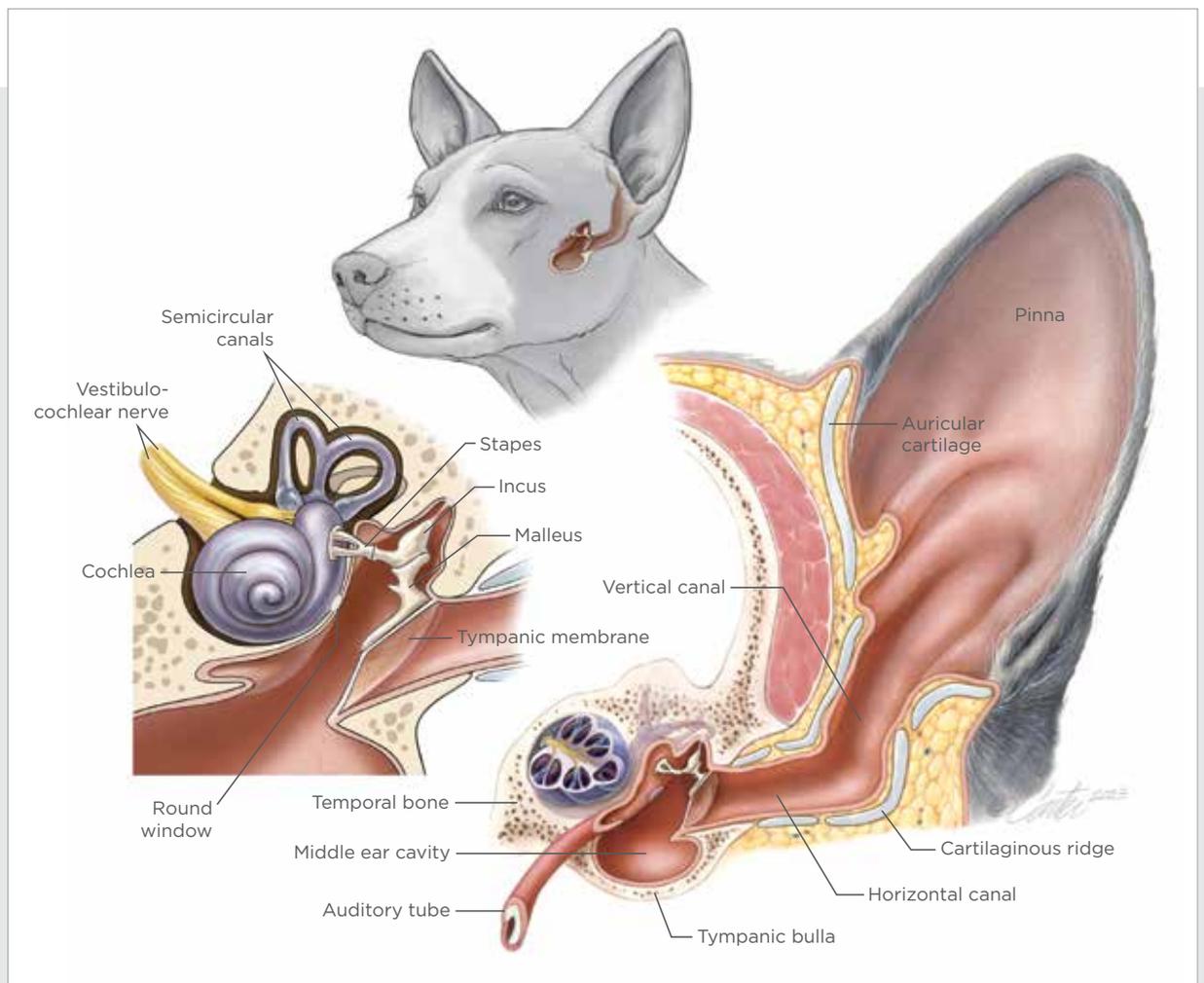
filled with air. The auditory tube connects the bulla to the sinuses and allows for adjustment to changes in pressure.<sup>1</sup>

The inner ear includes the semicircular canals, the vestibule, and the cochlea, which are all used to process sound waves and present them to the brain for analysis.

## SIGNALMENT

Ear disease can happen at any age and involve various causes and factors:

- Primary causes create disease in normal ears and induce infection without other causes; a primary cause alters the ear's environment and allows for the development of secondary infections.
- Secondary causes create disease in an abnormal ear due to changes in anatomy or physiology.



**FIGURE 1.** Anatomy of a canine ear.

Illustration: Kip Carter

- Perpetuating factors occur due to inflammation.
- Predisposing factors are present prior to ear disease and increase the risk of developing infections.<sup>1</sup>
- Breed predilection is due to primary causes such as atopy and predisposing factors such as increased hair in the ears, ceruminous gland hyperplasia, and pendulous pinnae.<sup>1</sup>

## CLINICAL SIGNS

Clinical signs of an ear infection include head shaking, ear scratching, odor, exudate, erythema, stenosis, head tilt, odd ear carriage, and hot spots on the cheeks.<sup>1,3</sup> On otoscopic examination, the health of the ear canal should always be noted by looking for ceruminous gland hyperplasia, increased vasculature, erythema, collapse of the canal walls, and the intactness of the tympanic membrane.<sup>3-5</sup>



**FIGURE 2.** Normal ear canal and tympanic membrane. Manubrium can clearly be seen.



**FIGURE 3.** Abnormal ear canal with discolored, bulging tympanic membrane.

## EXAMINATION AND CYTOLOGY

To perform an otic exam, one must understand the anatomy of the ear. The canal itself will travel along the side of the face, then angle into the head toward the back of the eye. When doing the otic exam, grasp the base of the ear pinna and gently pull it perpendicular to the patient and slightly rostrally (**FIGURE 4**). This will help straighten out the canal to allow for easier visualization of the tympanic membrane.<sup>3</sup> When visualizing the canals, care must be taken to not rub or bump against the canal wall as this can cause inflammation that may lead to an infection.<sup>4</sup>

Cytology should always be performed before treating the ears to ensure the correct treatment is recommended.<sup>1,4</sup> Collecting cytologic samples from the ear can cause trauma if not done correctly. Often, the collection is done too aggressively or the correct sample is not obtained. Collecting a sample too aggressively can create inflammation in an already friable ear and possibly cause an ulcer.<sup>6</sup> The exudate outside the canals on the pinna is not diagnostic material. The sample should be taken as close to the junction of the vertical and horizontal canals as possible.<sup>4,5</sup> Pull the pinna



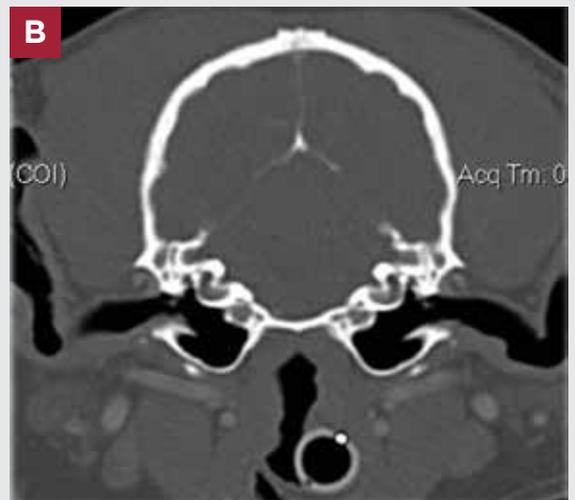
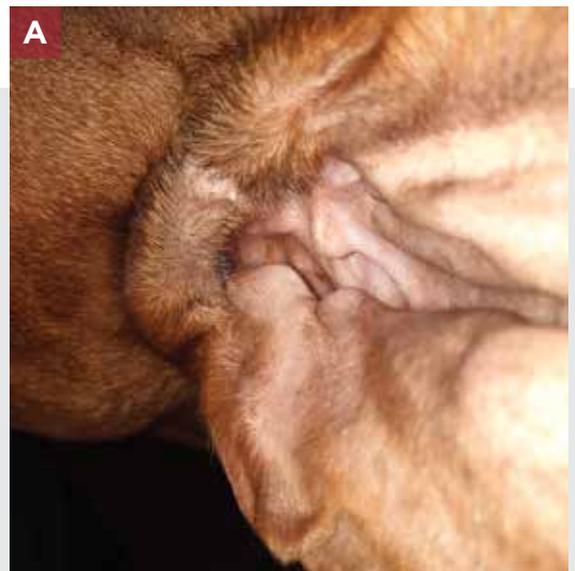
**FIGURE 4.** Otoscopic examination. Gently grasp the pinna and pull away from the head. Gently insert ear cone without touching the canals.



**FIGURE 5.** Ear cytology. Gently grasp the pinna and pull away from the head. **(A)** Insert swab into the horizontal canal. **(B)** Spin on the long axis only. **(C)** No need to scoop.

perpendicular to the patient, gently insert the swab into the canal, and spin the swab on the long axis 3 to 4 times (**FIGURE 5**). There is no need to scoop out material; if material is in there to collect, you will get it.

The most common findings on otic cytology are cocci (spherical bacteria), yeast, and bacilli (rod-shaped bacteria).<sup>1,7</sup> Occasionally, opportunistic fungal hyphae or a foreign body may be present. A foreign body or mass would be easier to see on exam but can be suspected in unilateral disease or with an increased number of white blood cells (WBCs) found on cytology.<sup>4</sup> WBCs are not common in ear infections, except with rods, opportunistic fungi, or a foreign body



**FIGURE 6.** **(A)** Early stage of ear disease. **(B)** Computed tomography scan of a normal to early-stage patient. Canals are open and of normal thickness; bullae are eggshell thin and full of air.

or mass.<sup>4</sup> Yeast infections are the simplest to treat; these rarely progress into middle ear disease. Coccoid and rod bacteria will eventually set up in the bulla, causing otitis media. Opportunistic fungi and foreign bodies can travel into the bulla, but it is unlikely. A mass can be an inflammatory polyp or neoplasia (benign or metastatic, although ear masses rarely metastasize).<sup>6</sup> These can originate in the canal or bulla.

### STAGES OF EAR DISEASE

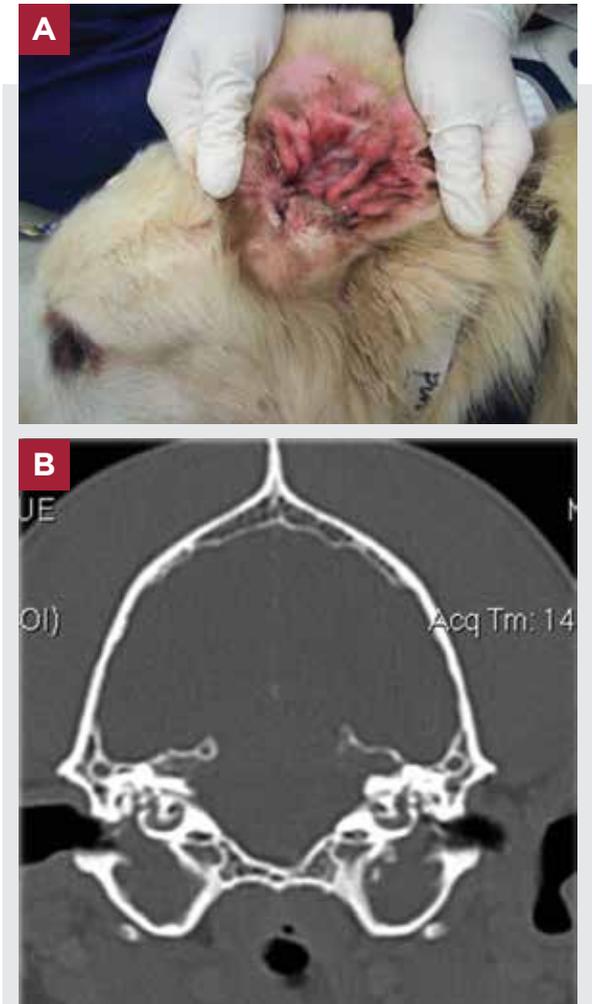
The author likes to categorize ear disease into 3 stages: early, chronic, and end stage.

Early stage occurs when the canal is still pliable and infections are infrequent (FIGURE 6). These infections

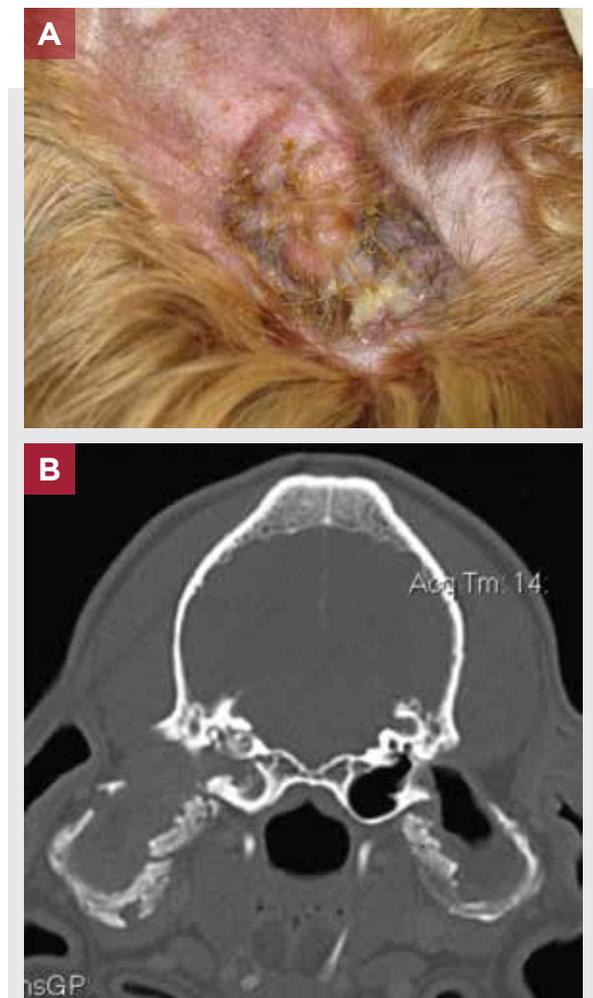
are easy to treat and are limited to the external ear canal. There are no changes to ear canal health.

Chronic ear disease causes auricular cartilage thickening, resulting in a decrease in canal pliability. Canals with chronic ear disease can range from less pliable to firm and can have mild to severe stenosis, erythema, and/or ceruminous gland hyperplasia (FIGURE 7A).<sup>6</sup> By this stage, there is a high probability of middle ear involvement (FIGURE 7B).<sup>6</sup>

End-stage ears typically develop after many years of chronic infection (FIGURE 8A). These patients are typically in great pain, but many owners do not realize this because of the length of time it took to get to this point and because owners tend to associate their pet's



**FIGURE 7. (A)** Chronic stage of ear disease. **(B)** Computed tomography scan of chronic ear disease. Canal walls are thickened and bullae are much thicker in appearance, with material noted in both bullae.



**FIGURE 8. (A)** End-stage ear disease. **(B)** Computed tomography scan of end-stage ears. Canals are completely stenotic, with partial to complete calcification, and bullae walls are thick, with material noted in 1 bulla.



slowing down with advancing age rather than pain. The canal itself will be completely stenotic and unresponsive to immunosuppressive doses of glucocorticoids, with partial to complete calcification of the ear canals (**FIGURE 8B**). There is a possibility of a resistant infection in the bulla.

## DIAGNOSIS

A culture and sensitivity documents what organisms are involved in the infection and which medication can be used for treatment. However, ear canal cultures are not useful when treating external ear infections topically.<sup>1</sup> The ability for antibiotics to concentrate in the skin of the canal is very low. Even if a culture shows that the infection is resistant to a certain antibiotic, it does not mean the infection will not respond to the antibiotic topically.<sup>1,5,7</sup> This is because topical medications place a higher concentration of the drug directly on the infection. A culture sample should only be collected from the bulla because the antibiotic needs the ability to penetrate bone.

To obtain a culture sample from the bulla, the patient must be fully anesthetized as the myringotomy (surgery to perforate the ear drum) is very painful. Most dermatologists typically recommend a computed tomography (CT) scan first (if available) to ensure that a myringotomy is necessary. If the CT scan shows there is no material in the bulla and the tympanic membrane appears normal on examination, it is best if a myringotomy is not performed. The bulla culture can be done with an open-ended tom cat catheter or a polypropylene catheter. When performing the myringotomy, be sure to perforate the pars tensa.<sup>8</sup> Gently instill 0.5 to 1 mL of sterile saline into the bulla

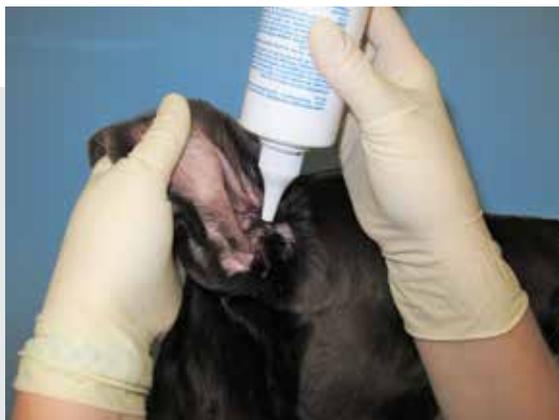
and aspirate the material. Place the entire volume of liquid into the culturette. Copious amounts of sterile saline should then be flushed into the bulla to retropulse the bulk of the infection out.<sup>5</sup> This is usually done under high pressure.<sup>8</sup> Afterward, the ear canal itself can be thoroughly cleansed. If *Pseudomonas* is present on cytology, the biofilm will need to be physically scraped off the canal wall.

Primary secretory otitis media (PSOM) is commonly seen in Cavalier King Charles spaniels.<sup>1,9</sup> It is a condition where mucus builds up in the bulla, causing a slow decrease in hearing or acute hearing loss. It is very difficult to distinguish signs of PSOM versus signs of Chiari-like malformation (CM), as they are virtually the same. CM is where the cerebellum is too large for the brain cavity and puts pressure on the brainstem and spinal cord. The best way to diagnose PSOM is by CT, which shows bone better than tissue and can show whether a bulla is hollow (normal) or full. A magnetic resonance imaging scan, which shows tissue much better than bone, is needed to diagnose CM but can also be used to see if the bullae are full.

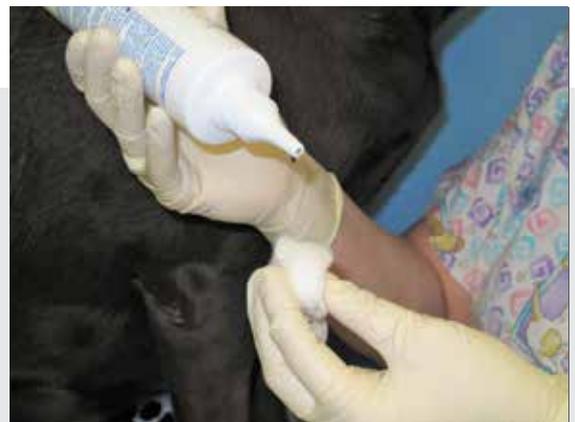
## CLEANING AND MEDICATION TECHNIQUES AND TIPS

Any time an ear flush or medication is sent home with an owner, the owners should be shown how to properly perform the flush or treatment. Two different techniques are used.

The “pour” technique (**FIGURE 9**) is used for in-hospital cleaning:



**FIGURE 9.** Ear cleaning: “pour” technique.



**FIGURE 10.** Ear cleaning: “cotton ball” technique. This technique is usually better tolerated by patients, especially those who are head shy.

1. Pull the ear up to open the external portion of the ear canal.
2. Without touching the bottle to the canal walls, fill the canal with solution.
3. Massage the canal for a few minutes.
4. Let the patient shake its head.

The biggest problem with this technique—and the main reason owners should not be shown how to do it this way—is that the medication bottle tip can be inserted all the way into the canal, which contaminates the entire bottle with the organism in the ear. It is also important to keep patients from immediately shaking their heads. The cleaner needs some time to soften the material in the ear canal before being shaken out.

For owners, the simple “cotton ball” technique (**FIGURE 10**) is usually recommended:

1. Soak a full-sized cotton ball until it is fully saturated and dripping.
2. Gently insert the cotton ball into the opening of the ear canal.
3. Massage the canal for a few minutes.
4. Use the cotton ball to wipe out any debris in the outer portion of the canal.
5. Let the pet shake its head.

The centrifugal force of the patient shaking its head will remove more of the debris from the horizontal canal than can physically be removed. Cotton-tipped applicators should not be used for cleaning the ear canal—not because there is a concern for rupturing the tympanic membrane but because there is a higher chance that the debris from the canal will be pushed deeper into the horizontal canal instead of being removed.<sup>1,5</sup> This material can harden into a ceruminolith that is usually difficult to flush out and typically will need to be physically removed.<sup>6</sup>

Cleaning can be time-consuming and should be performed depending on risk:

- Normal healthy patients should only have their ears cleaned as needed.<sup>3</sup>
- Patients that have a risk of getting ear infections should have their ears cleaned weekly to monthly. Those at risk include breeds known to have ear issues (e.g., basset hounds, cocker spaniels, German shepherds); breeds prone to allergic skin disease (e.g., bulldogs, Labrador retrievers, pit bulls); and those that have congenital reasons for ear disease, such as increased hair in the ear canal, heavy flopped ears, and hyperplastic ceruminous glands (e.g., basset

hounds, cocker spaniels, poodles, West Highland white terriers).<sup>1</sup>

Be sure to always instruct owners to clean first, then medicate.<sup>3</sup>

## TREATMENT AND MEDICAL MANAGEMENT

There are many over-the-counter ear treatments that can be chosen depending on the need of the patient. There is always normal bacterial flora, whether you can see it on cytology or not. If an antibacterial ear medication is used, the normal bacterial flora can become resistant to that antibiotic. Also remember that rods can create a biofilm along the ear canal. This biofilm will protect the organisms from antibiotherapy, and many ear medications cannot penetrate this biofilm. The only way to remove this biofilm is to physically scrape it off the canal walls. This is very painful and should only be done under anesthesia.

Early-stage ear disease is treated topically with regular ear flushing and otic medications.<sup>1,3</sup> With chronic ear disease, there are new medicated coats (Claro [Elanco, [elanco.com](http://elanco.com)], Osrurnia [Dechra, [dechra-us.com](http://dechra-us.com)]) that can be used in place of lanolin packs using enrofloxacin, ketoconazole, and triamcinolone. These continue to work for 4 to 5 weeks and have a gel consistency, so are not occlusive. Be sure to clean and dry the patient's ears thoroughly before instilling the product. Use caution with these products for 2 reasons:

1. Both products have a potent steroid that can cause problems if not used correctly.
2. There is a U.S. Food and Drug Administration warning out for both gel products to use care when instilling.

If either product touches your eyes, it cannot be washed off, and the medications will stay on your cornea for 30 days. *These products should only be used in the hospital and not sent home with owners.* Osrurnia treatment must be repeated in 1 week, and Claro is a one-time treatment that lasts for up to 30 days. Do not clean or treat the ears during this time. Have the owners restrict swimming during the treatment time, and be sure to remind them to use caution around the ears when bathing.

Otitis media should be considered when the ears respond to topical medications but relapse within a few weeks.<sup>8</sup> Topical medications do not concentrate in high



enough levels to treat the bulla; they will only treat the external canal.<sup>1</sup> Once the infection of the external canal is cleared, the material within the bulla can slowly reinfect the external canal.<sup>10</sup> If the bulla is not treated, the infection will never fully resolve.

If the patient is experiencing stenosis of the canal, immunosuppressive doses of steroids for 2 to 3 weeks can be attempted to see if the stenosis can be reversed.<sup>3</sup> If there is no lumen, medical management will fail.

The best procedure for medical management of chronic ear disease is a CT followed by a myringotomy and bulla flush (**FIGURE 11**). This procedure is done under anesthesia, and a regional block of the ears can be done to decrease pain. Due to the close proximity of the ear canal to the facial nerve, irritation and paralysis of the facial nerve are a concern. Typically, this is only transient, but there is a risk of it being permanent. Once the patient is blocked, either a handheld or video otoscope is used to visualize the tympanic membrane. If the tympanic membrane is intact and material was noted on CT, a color change to the tympanic membrane should be visible.<sup>1</sup> Instead of being slightly transparent, it will be white to green in color, and there can be some bulging as well. A myringotomy is then performed. Once access to the bulla has been acquired, a copious amount of sterile saline, under high pressure, is retro-pulsed into the bulla to help flush the infection out. If a culture needs to be obtained, it should be done



**FIGURE 11.** Bulla flush using a video otoscope, 3.5F polypropylene catheter, and pressurized saline to retro-pulse material out of the bulla.

prior to flushing.<sup>1</sup> Once the bulla flushes clear, the external ear canal can be deep cleaned to remove all the pus and biofilm, if present. Always be sure to double check that your patient can blink. If there is partial paralysis, eye lubrication will need to be sent home with owners until the patient can blink again. This ability can typically take 2 to 5 days to return.

PSOM removal is not much different than a bulla flush, except the PSOM is typically sterile and develops a thick, off-white mucus plug in the bulla. During the procedure, copious amounts of squalene are typically used to encourage the mucus to release from the sides of the bulla. How long the mucus has been in the bulla will determine the thickness of the mucus plug (**FIGURE 12**). Thinner mucus can be retro-pulsed out of the bulla, whereas thicker mucus will need to be manually removed using a polypropylene catheter and a lot of negative pressure.<sup>11</sup> If PSOM was the cause of the hearing loss, once it is removed, the patient should be able to hear. Side effects of PSOM removal are no different than those from a bulla flush.

The only treatment for patients with resistant infection in the bulla is a total ear canal ablation and bulla osteotomy (TECABO) (**FIGURE 13**).<sup>1,8</sup> The TECABO surgery consists of the ear canals being removed en bloc and a small opening made in the bulla to remove the infection and entire epithelial lining. (“En bloc” means to surgically remove organs or tissue in their entirety without dissection.) The longer the ears are infected, the thicker the calcification gets. The facial nerve, which runs alongside the ear canal, can become trapped within the calcification. At this point, the only way to



**FIGURE 12.** Mucus plug causing deafness pulled from the bulla of a Cavalier King Charles spaniel with primary secretory otitis media.

remove the canal is to cut the facial nerve, which will cause stroke-like signs. These patients will not be able to blink; therefore, they will need eye lubrication for life. Irritation to the facial nerve is also possible during surgery (even if the facial nerve is not cut); therefore, monitoring the ability to blink after surgery is important. Additional side effects of this surgery include head tilt, Horner's syndrome, facial droop, and other neurologic signs, depending on how much trauma was caused to the inner ear. Side effects of this surgery can be transient (taking up to 90 days for signs to resolve) or permanent.

## CONCLUSION

Managing ear disease can be very frustrating and costly for owners. Some treatments are easy and inexpensive; others can get expensive and extensive. Excellent client communication and management of the underlying

disease is required to properly manage the ears. If caught early, many patients with ear disease can be managed successfully long term. The trick is to catch the problem soon enough and manage the disease that is causing the infection. **TVN**

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**FIGURE 13. (A)** Total ear canal ablation and bulla osteotomy (TECABO) postsurgery and completely healed. **(B)** Computed tomography scan of a TECABO. Note the lack of ear canal and hole in the bulla.



### Amanda Friedeck

Amanda started working at Texas A&M Small Animal Teaching Hospital in 1995, and her focus has been strictly dermatology since 2003. In 2007, she graduated with a bachelor's degree in animal science from Texas A&M, was licensed in Texas in 2014, and earned her dermatology specialty license in 2018. Amanda is currently on the Board of Regents for her specialty and is also on the examination and credentialing committees. Amanda has published articles and a book chapter and enjoys speaking on dermatologic conditions. Her hobbies include spending time with her daughter and showing her Rhodesian ridgebacks in conformation, lure coursing, and agility.