

Oh, Oh Otitis:

Using Ear Cytology to Guide Clinical Management of Acute Otitis

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IDEXX

Conflict of Interest Disclosure:

I have financial interest, arrangement or affiliation with IDEXX Laboratories, Inc:

Full-time employee, Medical Consulting Services Dermatology

The information contained herein is intended to provide general guidance only. As with any diagnosis or treatment you should use clinical discretion with each patient based on a complete evaluation of the patient, including history, physical exam and presentation, and laboratory data. With respect to any drug therapy or monitoring program, you should refer to applicable product insert(s) for complete description of dosage, indications, interactions, and cautions. Diagnosis, treatment, and monitoring should be patient specific and is the responsibility of the veterinarian providing primary care. (2024)

Learning Objectives

- 1 | Prevalence of otitis and the PPSP System
- 2 | Importance of history and examination
- 3 | Otic diagnostics for diagnosis and monitoring
- 4 | Treatment protocol considerations
- 5 | How to handle persistent and recurrent infections

Acute Otitis: Clinical Approach and Case Evaluation

Definitions

Ear infection

- Dysbiosis (overgrowth) vs infection (leukocytes)

Otitis externa

- Inflammation of the vertical and/or horizontal canal

Otitis media

- Inflammation of the tympanic cavity and membrane

Otitis interna

- Inflammation of the membranous and bony labyrinth

Sources:

1. Jangí Bajwa, Canine otitis externa. *Can Vet J* 2019 Jan 60 (1): 97-99
2. Tim Nuttall, PhD, MRCVS, Managing recurrent otitis externa in dogs: what have we learned and what can we do better? *JAVMA*, Vol 261, NO. S1, June 2023, S10-S22
3. Manolis Saridomichelakis, Rania Farmaki, Leonidas Leontides, Alexander Koutinas, Aetiology of canine otitis externa: a retrospective study of 100 cases. *Veterinary Dermatology*, Oct 2007. 18; issue 5; 285-388 --341-347
Published in World Congress Proceedings p 165

Acute Otitis

- Less than 3 months duration
- Uncomplicated, new
- Without acquired proliferative changes



Erythema and Inflammation on otoscopic exam

Image courtesy of Christina Gentry DVM, DACVD, TAMU Teaching Collection

Source:

1. Bajwa J. Canine otitis externa - Treatment and complications. Can Vet J. 2019 Jan;60(1):97-99. PMID: 30651659; PMCID: PMC6294027

Classifying Otitis Externa: The PPSP System

Primary Cause(s)

Trigger inflammation

Predisposing Factor(s)

Allow inflammation

Secondary Cause(s)

Occur in combination with inflammation

Perpetuating Factor(s)

Maintain inflammation

Primary Causes

- Hypersensitivities
- Parasites
- Foreign body
- Space-occupying lesion
- Keratinizing disorders
- Endocrinopathy
- Autoimmune



Sources:

1. Nuttall T. Managing recurrent otitis externa in dogs: what have we learned and what can we do better? *J Am Vet Med Assoc*. 2023 Apr 7;261(S1):S10-S22. doi: 10.2460/javma.23.01.0002.
2. Koch S. The challenge of chronic otitis in dogs—from diagnosis to treatment. *Today's Vet Pract*. 2017;7(3):60–70
3. Saridomichelakis MN, Farmaki R, Leontides LS, Koutinas AF. Aetiology of canine otitis externa: a retrospective study of 100 cases. *Vet Dermatol*. 2007 Oct;18(5):341-7. doi: 10.1111/j.1365-3164.2007.00619.x. PMID: 17845622.

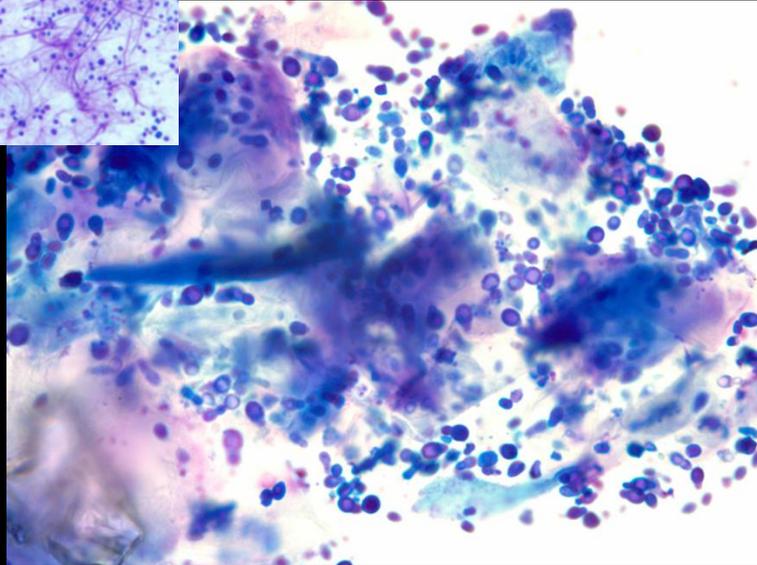
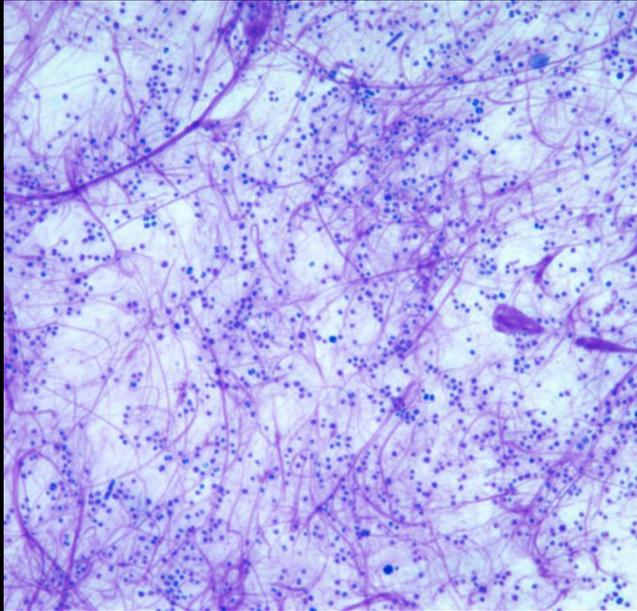
Predisposing Factors



- **Conformation**
- **Excessive moisture**
- **Inappropriate treatment**
- **Upper respiratory infections (cats)**

Sources:

1. Nuttall T. Managing recurrent otitis externa in dogs: what have we learned and what can we do better? *J Am Vet Med Assoc.* 2023 Apr 7;261(S1):S10-S22. doi: 10.2460/javma.23.01.0002.
2. Koch S. The challenge of chronic otitis in dogs—from diagnosis to treatment. *Today's Vet Pract.* 2017;7(3):60–70
3. Saridomichelakis MN, Farmaki R, Leontides LS, Koutinas AF. Aetiology of canine otitis externa: a retrospective study of 100 cases. *Vet Dermatol.* 2007 Oct;18(5):341-7. doi: 10.1111/j.1365-3164.2007.00619.x. PMID: 17845622.



Images courtesy of Christina Gentry DVM, DACVD, TAMU Teaching Collection

Secondary Causes

- **Bacteria**

Gram-positive cocci

Staphylococcus pseudintermedius

β -hemolytic *Streptococcus*

Gram-positive rods

Gram-negative rods

Pseudomonas aeruginosa

- ***Malassezia* spp**

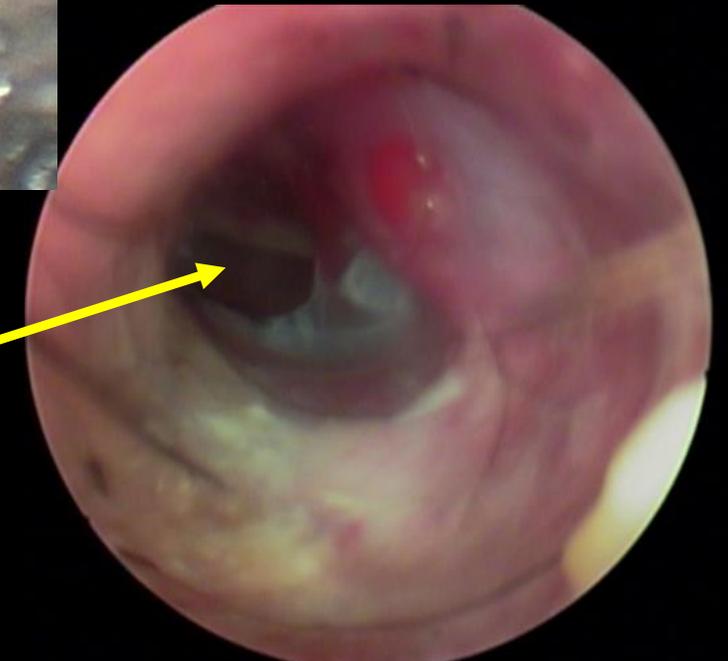
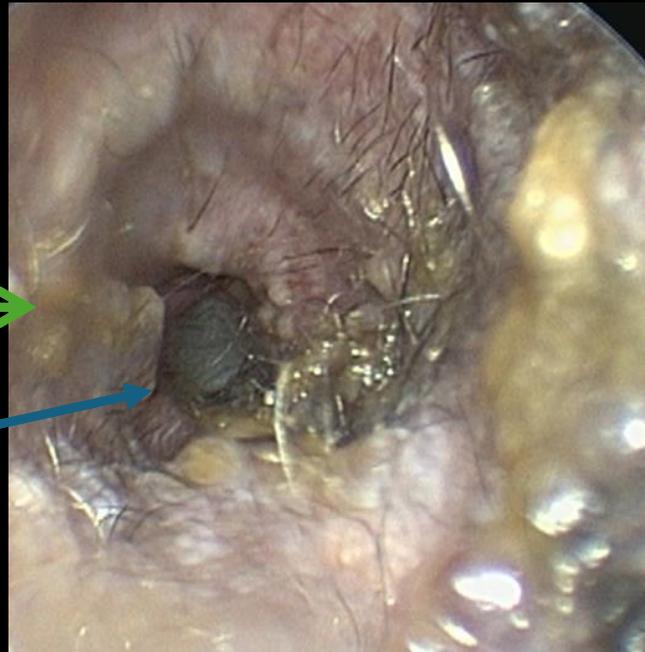
- **Biofilm**

Sources:

1. August JR. Otitis externa. A disease of multifactorial etiology. *Veterinary Clinics of North America-Small Animal Practice* 1988; 18: 731–42.
2. Nuttall T. Managing recurrent otitis externa in dogs: what have we learned and what can we do better? *J Am Vet Med Assoc.* 2023 Apr 7;261(S1):S10-S22. doi: 10.2460/javma.23.01.0002.
3. Koch S. The challenge of chronic otitis in dogs—from diagnosis to treatment. *Today's Vet Pract.* 2017;7(3):60–70
4. Saridomichelakis MN, Farmaki R, Leontides LS, Koutinas AF. Aetiology of canine otitis externa: a retrospective study of 100 cases. *Vet Dermatol.* 2007 Oct;18(5):341-7. doi: 10.1111/j.1365-3164.2007.00619.x. PMID: 17845622.

Perpetuating Factors

- **Epidermal and glandular hyperplasia**
Cobblestone appearance
- **Stenosis**
Occlusion
Fibrosis
Mineralization
- **Otitis media**
- **Tympanic membrane abnormalities**
- **Cholesteatoma formation**



Images courtesy of Christina Gentry DVM, DACVD, TAMU Teaching Collection

Sources:

1. Nuttall T. Managing recurrent otitis externa in dogs: what have we learned and what can we do better? *J Am Vet Med Assoc.* 2023 Apr 7;261(S1):S10-S22. doi: 10.2460/javma.23.01.0002.
2. Koch S. The challenge of chronic otitis in dogs—from diagnosis to treatment. *Today's Vet Pract.* 2017;7(3):60–70
3. Saridomichelakis MN, Farmaki R, Leontides LS, Koutinas AF. Aetiology of canine otitis externa: a retrospective study of 100 cases. *Vet Dermatol.* 2007 Oct;18(5):341–7. doi: 10.1111/j.1365-3164.2007.00619.x. PMID: 17845622.

Otitis Externa Factors and Causes

- Retrospective study, 100 otitis externa cases
- Chronic-recurrent (63%), bilateral (93%)
- Primary causes
 - Allergic dermatitis (43%), grass awns (12%), and acariasis (13%)
 - No primary factor (32%)
 - More than one factor (3%)
- Secondary causes
 - *Malassezia* spp. (66%), cocci (38%), and rods (22%)
- Perpetuating factors
 - Ear canal stenosis (38%), tympanic membrane perforation-otitis media (25%)

Source:

1. Saridomichelakis MN, Farmaki R, Leontides LS, Koutinas AF. Aetiology of canine otitis externa: a retrospective study of 100 cases. *Vet Dermatol.* 2007;18(3):341–347. doi:10.1111/j.1365-3164.2007.00619.x

A photograph of a light-colored dog swimming in a body of water, holding a log in its mouth. The background is a blurred green forest. The image is used as a background for the text on the right.

Dermatologic/ Otic History

Age of onset

First otitis or repeat offender

Duration of clinical signs

Response to treatment(s)

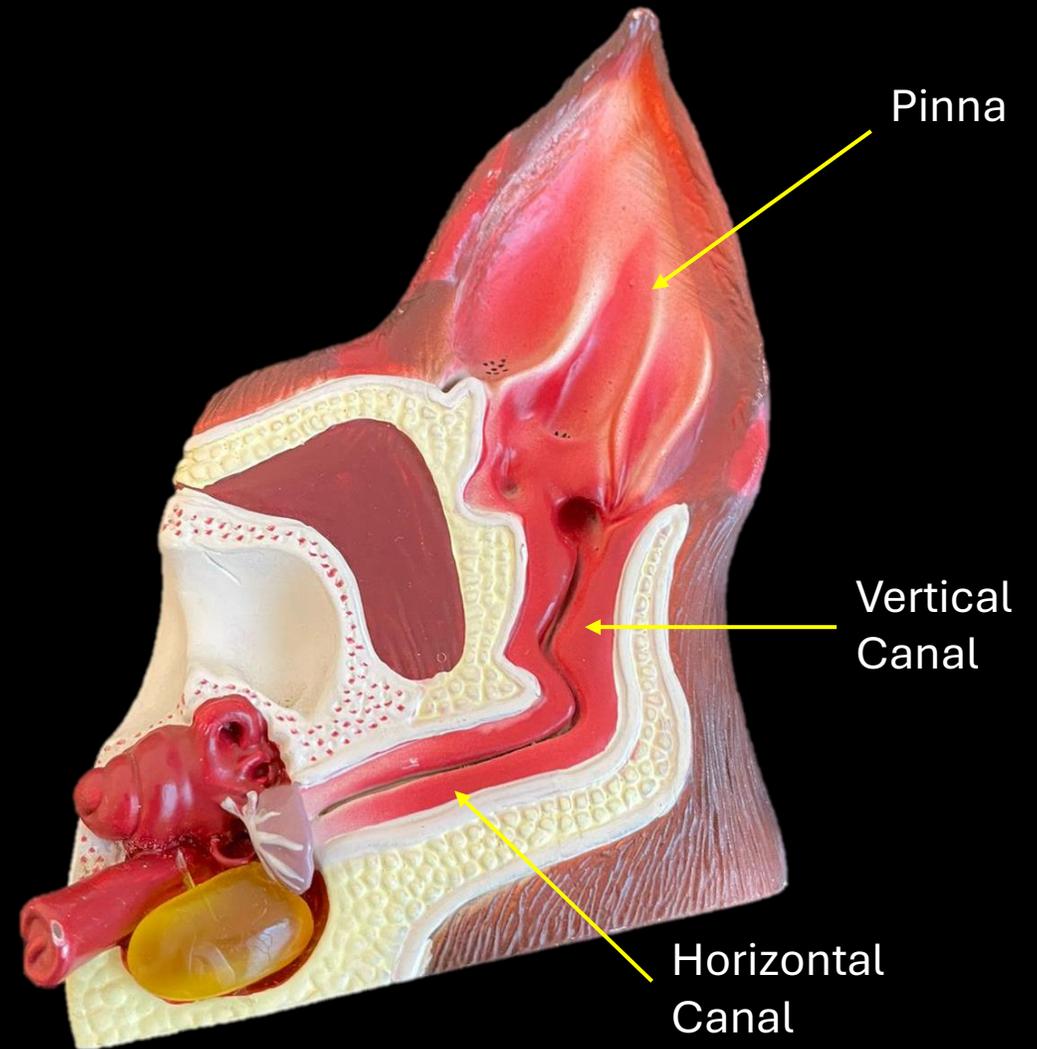
Seasonality

History of swimming/grooming

Systemic abnormalities

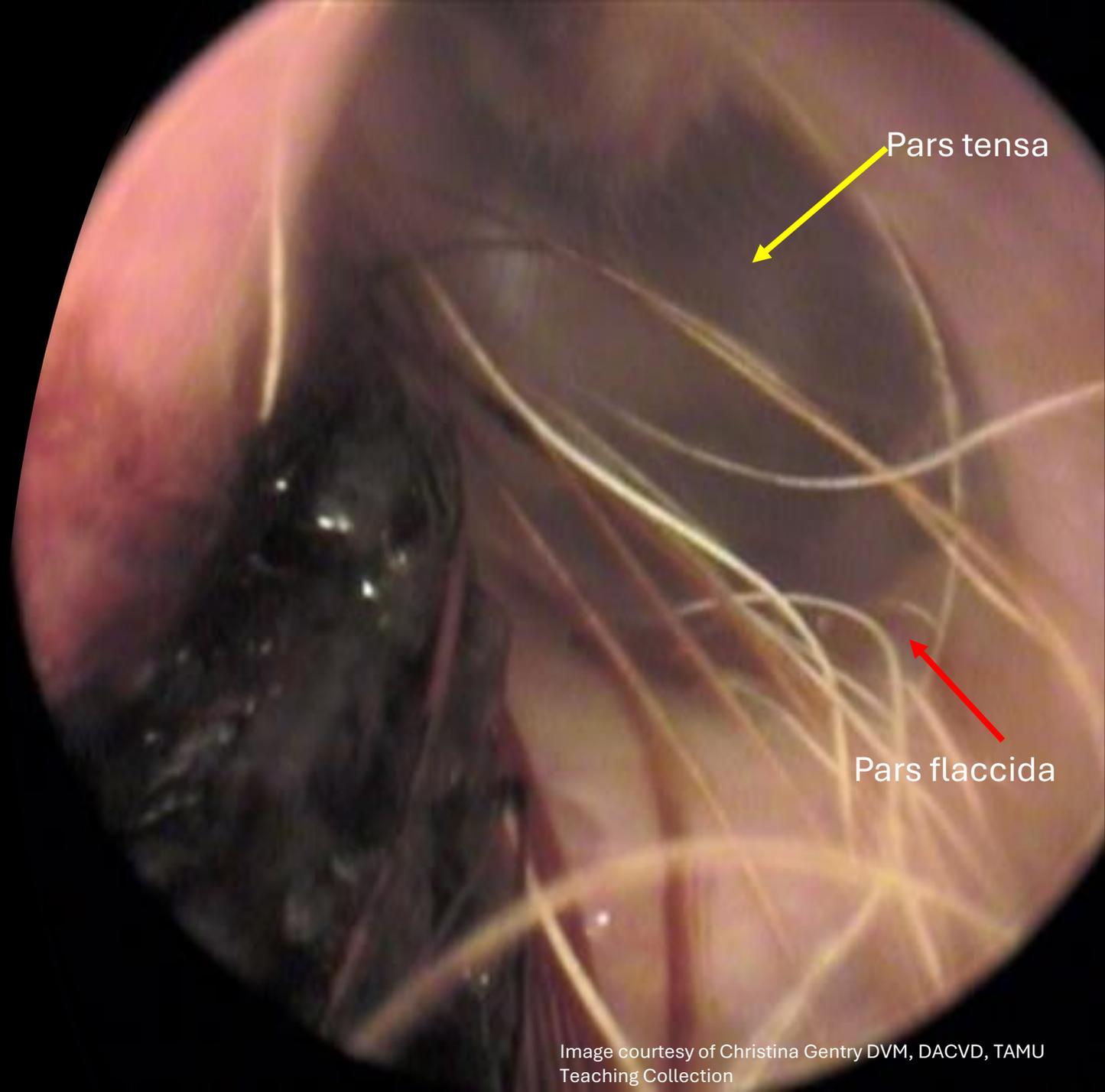
Otoscopic Examination

- Bilateral
- External pinnae
- Horizontal and vertical canals:
 - Discharge
 - Hyperemia
 - Thickened walls
 - Calcification
 - Stenosis
 - Space occupying lesions
- Tympanic membrane



Healthy Tympanic Membrane

- **Pars tensa**- thin, fibrous, slight concave shape
- **Pars flaccida**- upper quadrant, ventrally attached to the lateral process of the malleus, opaque, pink, or white in color



Study:

Evaluation of otoscope cone disinfection techniques and contamination level in small animal private practice

Contamination in 29% of cones:

Potential pathogenic and non-pathogenic bacteria and yeast

Pseudomonas aeruginosa (6%) cultured only from quarternary ammonia based compounds

3.2% glutaraldehyde based product met criteria for sterilization when changed regularly, every 28 days

Take Home:

Frequent solution changes may decrease risk of otoscope cone contamination

Source:

1. Kirby, KL, Rosenkrantz, WS, Ghubash RM, Neradilek, BJ, Polissar, NL. Evaluation of otoscope cone disinfection techniques and contamination level in small animal private practice. *Vet Dermatol.* 2010; **21**(2): 175-183. <https://doi.org/10.1111/j.1365-3164.2009.00783.x>.



Diagnosics

Cytology

- + Slide with stain (Diff-Quik or Gram stain)
 - + Examine in-clinic: technicians versus doctors
- + Slide without stain
 - + Send out to reference lab: clinical pathologist
- + IDEXX inVue Dx™ Cellular Analyzer (no slide or stain)

Mite prep

- + Swab-mixed mineral oil, coverslip, low light
- + Curette sampling/ lactophenol cotton blue staining

Culture (external versus middle ear)

- + Aerobic
- + Fungal

Imaging

- + Radiographs
- + Computed tomography (CT): most cost-effective
- + Magnetic resonance imaging (MRI)

Sources:

1. Combarros D, Boncea AM, Brément T, Bourdeau P, Bruet V. Comparison of three methods for the diagnosis of otodectasis due to *Otodectes cynotis* in dogs and cats. *Vet Dermatol*. 2019 Aug;30(4):334-e96. doi: 10.1111/vde.12753
2. Nuttall T. Managing recurrent otitis externa in dogs: what have we learned and what can we do better? *J Am Vet Med Assoc*. 2023 Apr 7;261(S1):S10-S22. doi: 10.2460/javma.23.01.0002

Cytology



Cytology Options

Modified Wright (Diff-Quik®)

- Does not differentiate **Gram-positive** vs **Gram-negative**
- Cocci versus rods versus yeast
- Inflammatory cells
- Fairly simple and faster than Gram stain
- Heat fixation for cerumen
- 3-step stain
- High-dry 40× objective versus oil immersion 100× objective

Gram stain

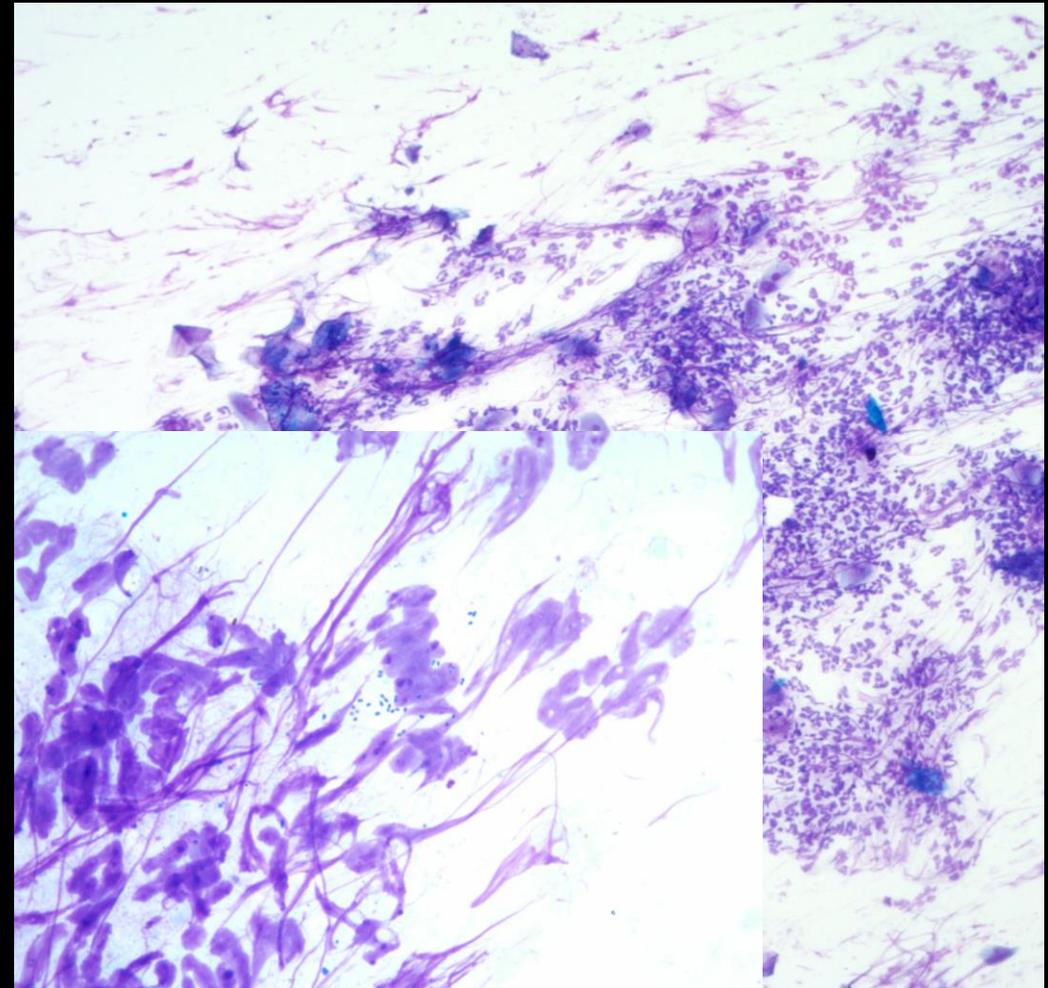
- Differentiates **gram-positive** vs **gram-negative**
- Cocci vs rods vs yeast
- Inflammatory cells
- More intensive steps and takes longer than Diff-Quik
- High-dry 40× objective versus oil immersion 100× objective
- Variable in clinic availability

• Reference lab clinical pathology

- More expensive
- Subjective
- Must request quantification
- Diff-Quik or Gram stain
- Several-day turnaround

Benefits of Cytology

- Types of organism(s) and cellular content
 - Most sensitive method for diagnosing *Malassezia*
 - Leukocytes, red blood cells, acanthocytes
- In vivo subjective quantification
 - Infection versus overgrowth
 - Response to therapy
 - Determine need for culture and sensitivity
 - Compliments culture and sensitivity testing
- Guides empiric treatment and duration
- Point of care



Images courtesy of Christina Gentry DVM, DACVD, TAMU Teaching Collection

Source:

1. Angus JC. Otic cytology in health and disease. *Veterinary Clinics of North America-Small Animal Practice* 2004; 34: 411–24.

Ear Swab Cytology

- Both ears
- Sample junction of vertical and horizontal canal
- Gently rotate to collect sample
- Roll and dab onto slide
- Lightly heat fix
- Stain in Diff Quick®
 - Light blue ~30 seconds
 - Eosinophilic ~ 60 seconds
 - Basophilic ~ 60-90 seconds
- Air dry
- Evaluate under high light and oil immersion



Cytology Pitfalls

- Need for trained staff
- Evaluation can be challenging
 - Rods versus melanin granules
 - Cocci versus stain precipitant
- Subjective interpretation
 - Variations between staff
- Mite preps are a separate process

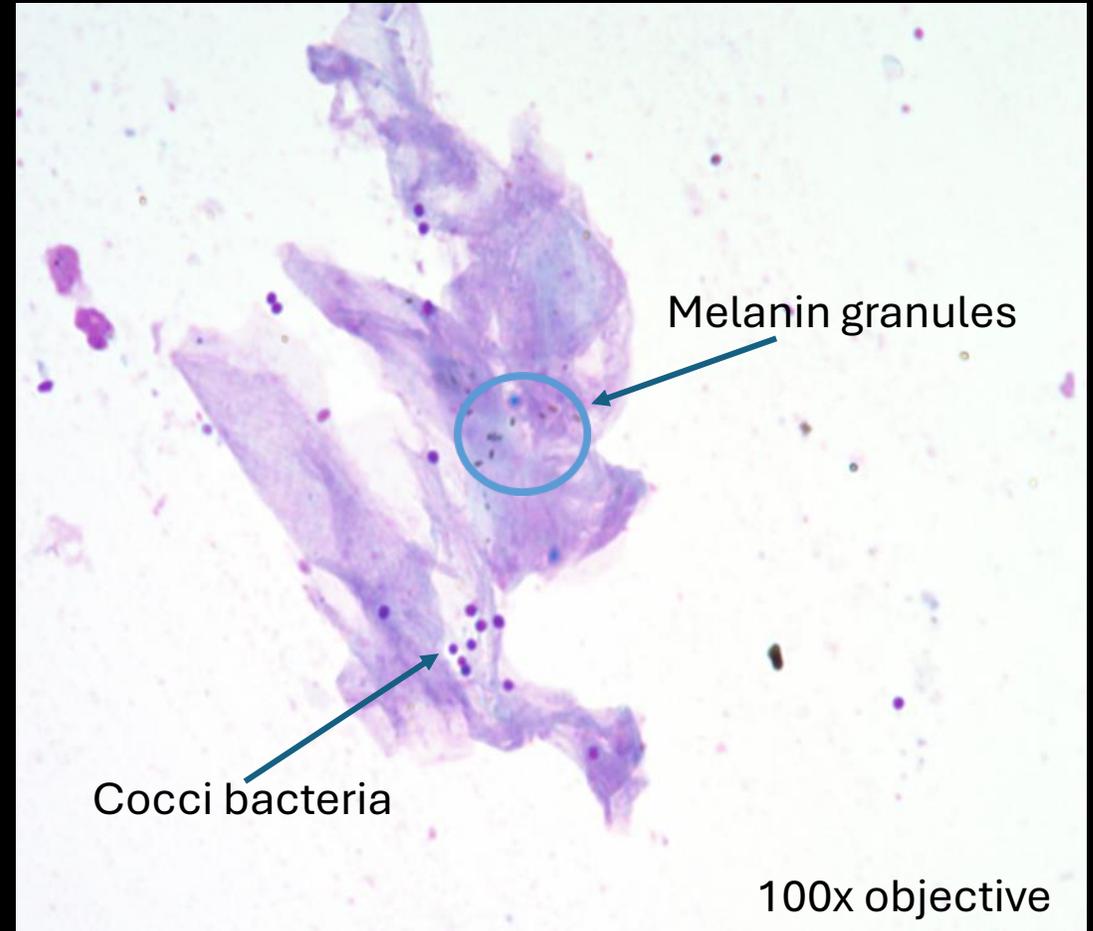
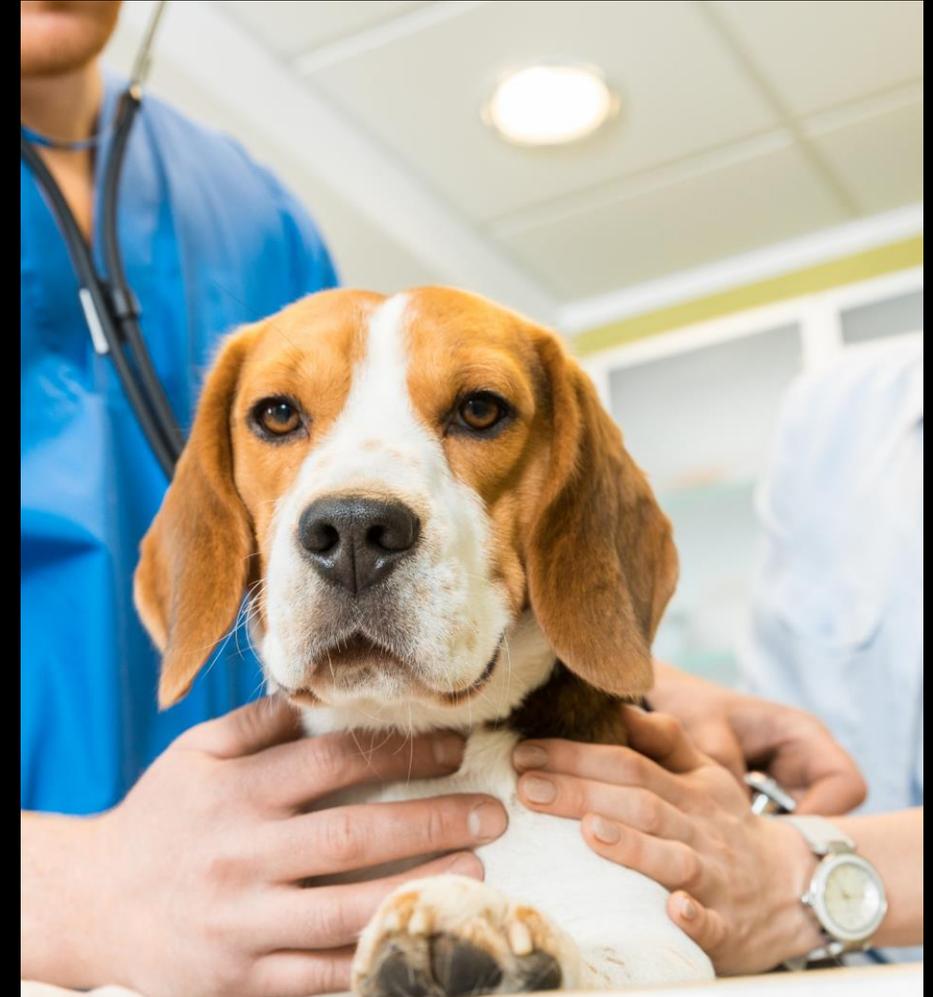


Image courtesy of Christina Gentry, DVM, DACVD, TAMU Teaching Collection

Subjective Cytologic Evaluation

	Normal	Gray zone	Abnormal
Malassezia			
Dog	≤ 2	3–4	≥ 5
Cat	≤ 2	3–11	≥ 12
Bacteria			
Dog	≤ 5	6–24	≥ 25
Cat	≤ 4	5–14	≥ 15

Recommended criteria for evaluating the significance of organisms present on otic cytology (based on mean number of organisms per high-dry 40 \times field of view)



Source:

1. Ginel PJ, Lucena R, Rodriguez JC, Ortega J. A semiquantitative cytological evaluation of normal and pathological samples from the external ear canal of dogs and cats. *Vet Dermatol.* 2002;13(3):151–156. doi:10.1046/j.1365-3164.2002.00288.x

Subjective Cytologic Evaluation

Classification 	Description 
Rare	1–3 organisms per <i>entire slide</i>
Occasional	Average of 1–5 organism per OIF
1+	Average of 6–10 organism per OIF
2+	Average of 11–20 organism per OIF
3+	Average of 21–30 organism per OIF
4+	Average of 31–40 organism per OIF
TNTC (too numerous to count)	Massive amount of organisms per OIF you can't possibility count them; rapidly detected without difficulty

Abbreviation: OIF is for oil immersion field.

Source: Goal two: skin and ear cytology. In: Ohio State University College of Veterinary Medicine. *OSU CVM Veterinary Clinical and Professional Skills Center Handbook*. 2018. Accessed September 4, 2024. https://ohiostate.pressbooks.pub/osuvcpshandbook/chapter/derm_exam-basic-techs_goal-two/

Cytology scale

0 = No bacteria/yeast/inflammatory cells

1+ = Occasional

bacteria/yeast/inflammatory cells, scan carefully for detection

2+ = Bacteria/yeast/inflammatory cells in low numbers, easily detected

3+ = Bacteria/yeast/inflammatory cells in large numbers, quickly detected

4+ = Massive amounts of bacteria/yeast/inflammatory cells, quickly and easily detected

Source: *Clinician's Brief, Clinical Skills, Dermatology*, May 2013.

<https://www.cliniciansbrief.com/article/standard-cytology-scale-what-your-practice>

Mite Preparation



When to mite prep

- Black, coffee ground debris
- Ceruminous debris
- Comedones
- Mites on otoscopic examination (movement)
- Young patient
- Immunocompromised patients
- Inflammatory cells, no organisms
- Lack of response to treatment

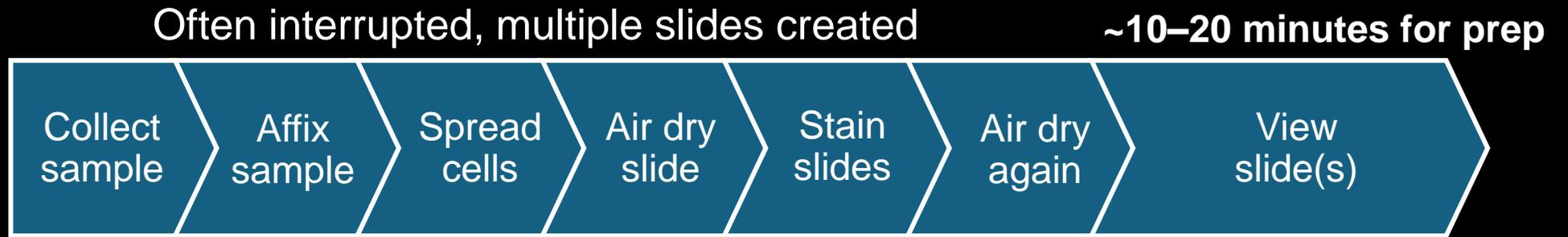
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New Innovation in Ear Cytology

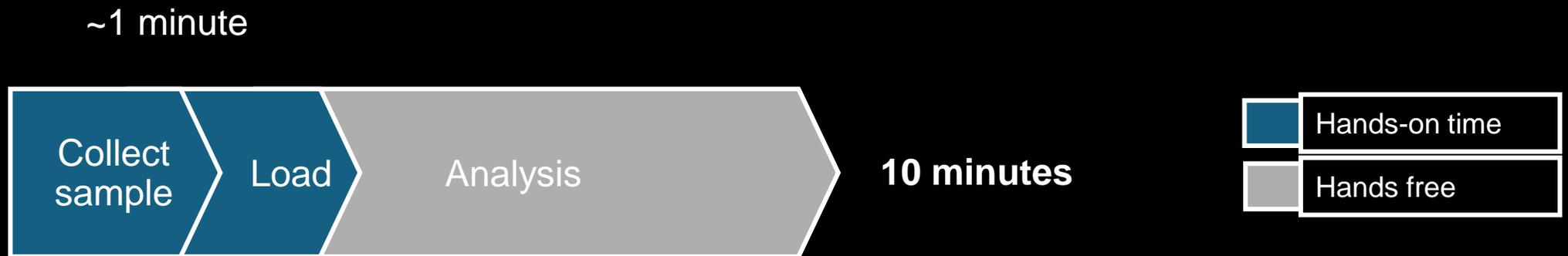


Gives Time Back to Practices

Microscope



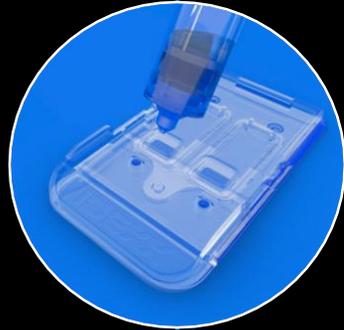
**IDEXX
inVue Dx™**



IDEXX inVue Dx™ Cellular Analyzer



1 Put sample in the reagent



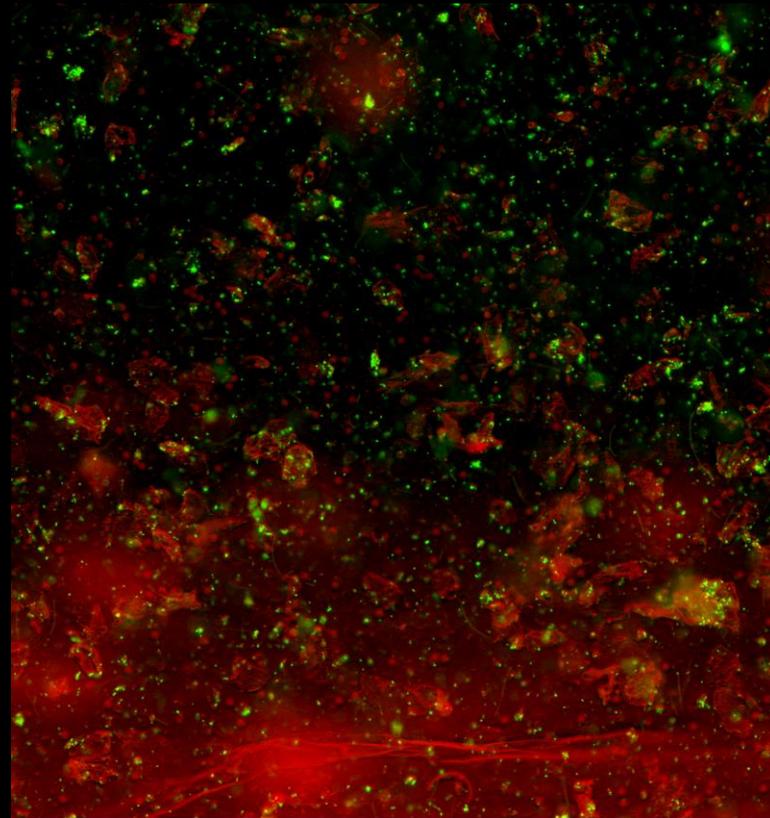
2 Drop sample into cartridge



3 Insert and press the Start button

IDEXX inVue Dx™ Cellular Analyzer

- Semiquantitative Results
 - Rod-shaped bacteria
 - Cocci-shaped bacteria
 - Yeast
- Presence detected
 - Mites
 - White blood cells



IDEXX VetLab Station | Bindf Brooks 123456 | Canine | Poodle | Female | 4 y | Profile

2025 May 14

Results Details | Manage Results

Cytology

5/14/25 8:02 AM

Visit Notes: Visit type: First time. Case duration: Chronic. Clinical signs: Patient presented signs of otitis including:
- Left ear pain, itchy, discharge (purulent (pus), bloody)

Source: Left Ear

Bacteria		
Rods	3-14	Numerous rod-shaped bacteria present
Cocci	3-14	Numerous coccoi-shaped bacteria present
Yeast	0	None to trace seen
WBC	--	
Mites	Absent	

Results: Both rods and cocci observed
Consideration: The co-presence of rods and cocci support bacterial otitis.
Next Step(s): In cases of persistent or recurrent infections, especially those with pus or discharge, evaluate the patient for the presence of biofilms, which can make bacteria resistant to antibiotics and require thorough ear cleaning as part of treatment. Use clinical signs, history, and diagnostics to evaluate for deeper involvement of the middle or inner ear. Administer appropriate antimicrobial and anti-inflammatory therapies based on clinical assessment.

Diagnostic Considerations: User has indicated that there is purulent discharge in the ear. Consider suppurative otitis clinically characterized by erythema, ulceration, and a purulent discharge often with a biofilm. These cases usually involve a Pseudomonas spp. infection but can rarely be associated with Staphylococcus or Malassezia. Address potential primary, predisposing, and perpetuating factors such as atopic dermatitis (food or environmentally triggered), tumor, otitis media, foreign body presence, infection and its potential extension to the middle ear, and address biofilm as part of your elected treatment as these protect bacterial colonies from antimicrobial therapy.

Images: Bacteria Assessment, Yeast and WBC Assessment (Composite), Yeast and WBC Assessment (Brightfield)

Source: Right Ear

Bacteria		
Rods	0	None
Cocci	0	None to trace seen
Yeast	0	None to trace seen
WBC	Absent	
Mites	Present	

Results: Otodectes otitis
Consideration: Any co-presence of bacteria, yeast, and/or white blood cells is likely secondary to ear mite infestation.
Next Step(s): Use an effective acaricide and manage any secondary infections or inflammation.

Images: Bacteria Assessment, Yeast and WBC Assessment (Composite), Yeast and WBC Assessment (Brightfield) +1

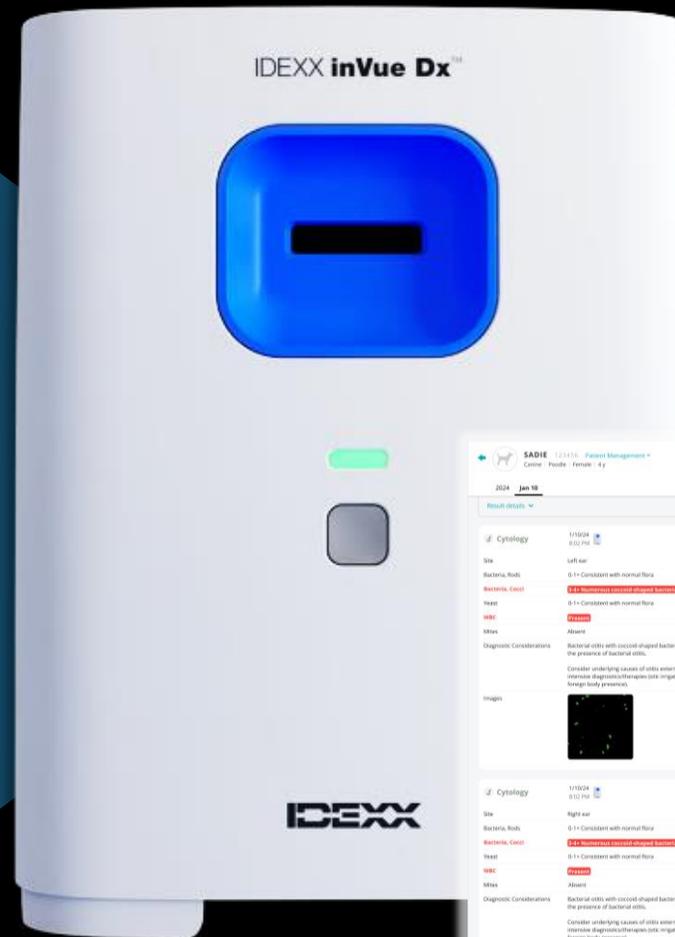
IDEXX inVue Dx™ Cellular Analyzer

Revolutionary
workflow

Slide-free, load-and-go

Plug-and-play
integration

Pay-per-run

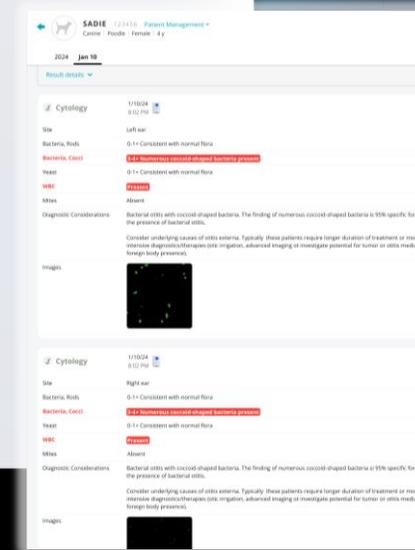


Deeper
insights

High-value menu

Consistent and
objective results

Advanced optics, deep
learning AI



Culture and Sensitivity

- Limited benefit in acute otitis externa
 - Lacking interpretative guidelines for topicals
 - Cytology is predictive
 - Yeast, rods, and cocci
 - Cytology is more sensitive for detecting yeast
- Indications:
 - Precise identification
 - *Pseudomonas aeruginosa*
 - Atypical morphology
 - Filamentous, cocco-bacilli, hyphae
 - Otitis media
 - Systemic antibiotic selection



Sources:

1. Nuttall T. Managing recurrent otitis externa in dogs: what have we learned and what can we do better? J Am Vet Med Assoc. 2023 Apr 7;261(S1):S10-S22. doi: 10.2460/javma.23.01.0002.
2. Morris DO. Medical therapy of otitis externa and otitis media. Vet Clin North Am Small Anim Pract. 2004 Mar;34(2):541-55, vii-viii. doi: 10.1016/j.cvsm.2003.10.009. PMID: 15062623.
3. Harvey BVSc DVD Dip ECVD FSB, R.G., & Paterson, S. (2014). Medical Management of Ear Diseases. In: Otitis Externa: An Essential Guide to Diagnosis and Treatment, 1st edn. CRC Press, Boca Raton, pp 81-103.

Treatment



Treatment Goals

1

Eliminate
discomfort and
pain

2

Clean and
remove debris
and exudate

3

Control
secondary
infection

4

Return canal to
normal state

5

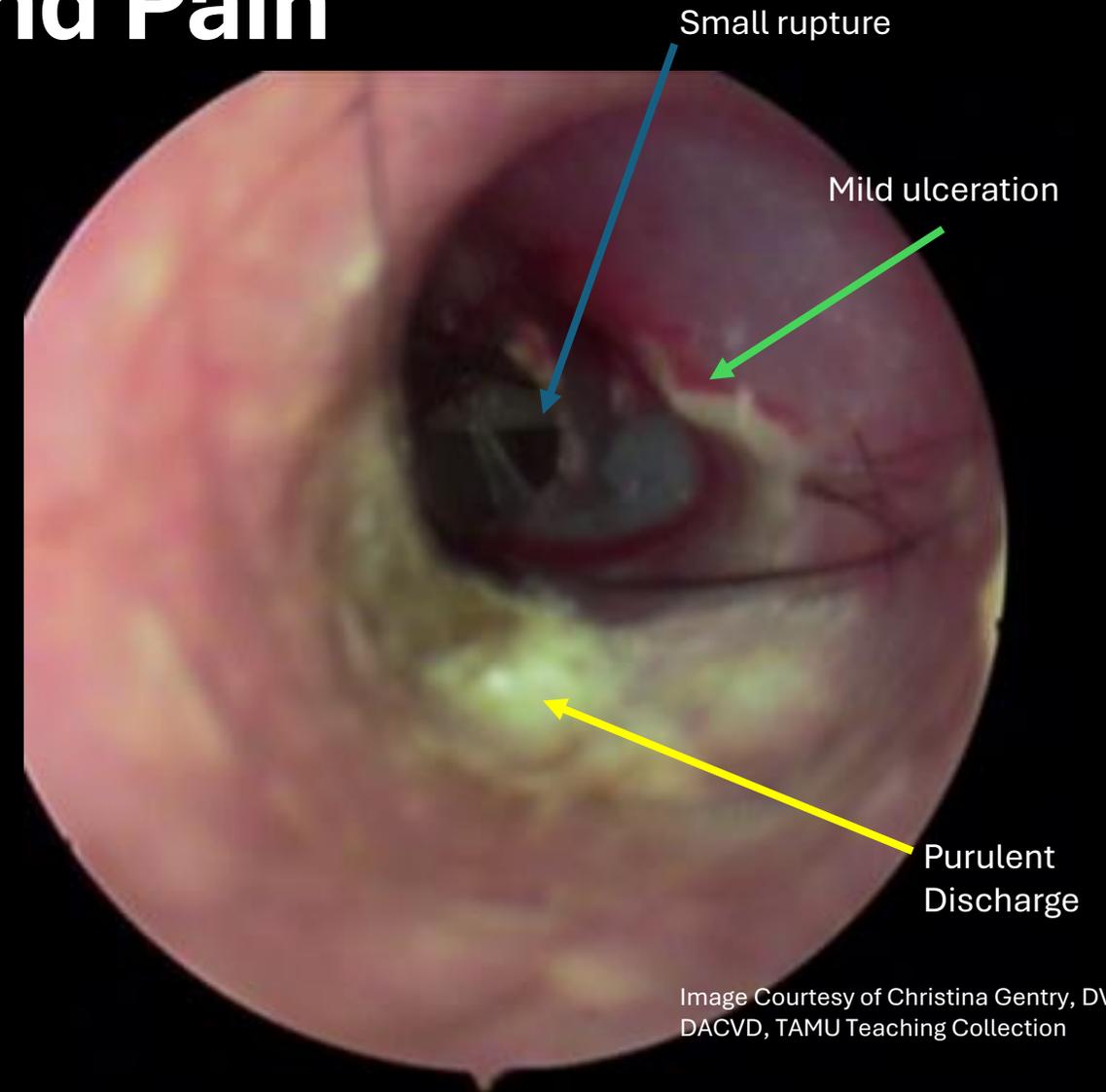
Identify and
manage the
underlying
primary cause(s)

Source:

1. Koch S. The challenge of chronic otitis in dogs—from diagnosis to treatment. *Today's Vet Pract.* 2017;7(3):60–70.

Eliminate Discomfort and Pain

- Glucocorticoids
 - Reduce inflammation
 - Decrease pain
 - Topical
 - Dexamethasone, betamethasone, mometasone, hydrocortisone aceponate
 - Daily then taper
 - Can suppress the hypothalamic-pituitary – adrenal axis
 - Systemic
 - Prednisone, prednisolone
 - 0.5-1 mg/kg orally daily, taper
- Cyclosporine
 - 5 mg/kg orally once daily
- Ilunocitinib
 - 0.6-0.8 mg/kg orally once daily
 - Over 12 months of age



Sources:

1. Nuttall T. Managing recurrent otitis externa in dogs: what have we learned and what can we do better? J Am Vet Med Assoc. 2023 Apr 7;261(S1):S10-S22. doi: 10.2460/javma.23.01.0002. PMID: 37019436.
2. Scott, D.W., Miller W.H., Griffin, C.E. Dermatologic therapy. In Scott, D.W., Miller, W.H., Griffin, C.E., eds. *Muller and Kirk's Small Animal Dermatology*, Philadelphia: W.B. Saunders, 2001, 207-73.

Deep Ear Cleaning



Video courtesy of Ariane Neuber Watts, DrMedVet, DECVD, IDEXX Laboratories

Pretreatment- Ceruminolytics

- Soft waxy debris
 - Ingredient: Dioctyl sodium sulfosuccinate (DSS) or propylene glycol (ototoxicity)
- Hard waxy debris
 - Ingredient: Squalene (unlikely to be ototoxic)
- AVOID in cats

Flush

- Isotonic (0.9%) saline
 - Warm to body temperature
- New bulb syringe
 - Don't occlude the canal

Video otoscopy/Handheld otoscope

- 20 ml syringe/12 ml syringe
- 5 -French polypropylene catheter/ 8-French polypropylene catheter

Evaluate the tympanic membrane

- Suction canal for visibility
- Collect samples for culture and cytology if ruptured, sterile otoscope cone
- Flush bulla with saline
 - Direct catheter ventrally

Sources:

1. Gortel K. Otic flushing. *Vet Clin North Am Small Anim Pract.* 2004 Mar;34(2):557-65. doi: 10.1016/j.cvsm.2003.10.010. PMID: 15062624.
2. Mansfield PD, Steiss JE, Boosinger TR, Marshall AE. The effects of four, commercial ceruminolytic agents on the middle ear. *J Am Anim Hosp Assoc.* 1997 Nov-Dec;33(6):479-86. doi: 10.5326/15473317-33-6-479. PMID: 9358414.

Treatment Pearls

Dosages

- Measure medications
 - 0.25 ml small dogs, cats
 - 0.5 ml medium size dogs
 - 1 ml large dogs
 - 1.5-2 ml giant breeds
- Systemic medications
 - High end of dosage range

Treatment

- Treat to cytologic and clinical resolution
- Rechecks every 10-14 days
- Systemics for otitis media 6-8 weeks

Malassezia

- 1% miconazole nitrate lotion every 12 hours
- Acetic acid based cleaner

Tris-EDTA

- Pre-treat 10 minutes prior to aminoglycosides or fluoroquinolones
- *Pseudomonas aeruginosa*
- May decrease efficacy of silver sulfadiazine (SSD)

Enrofloxacin

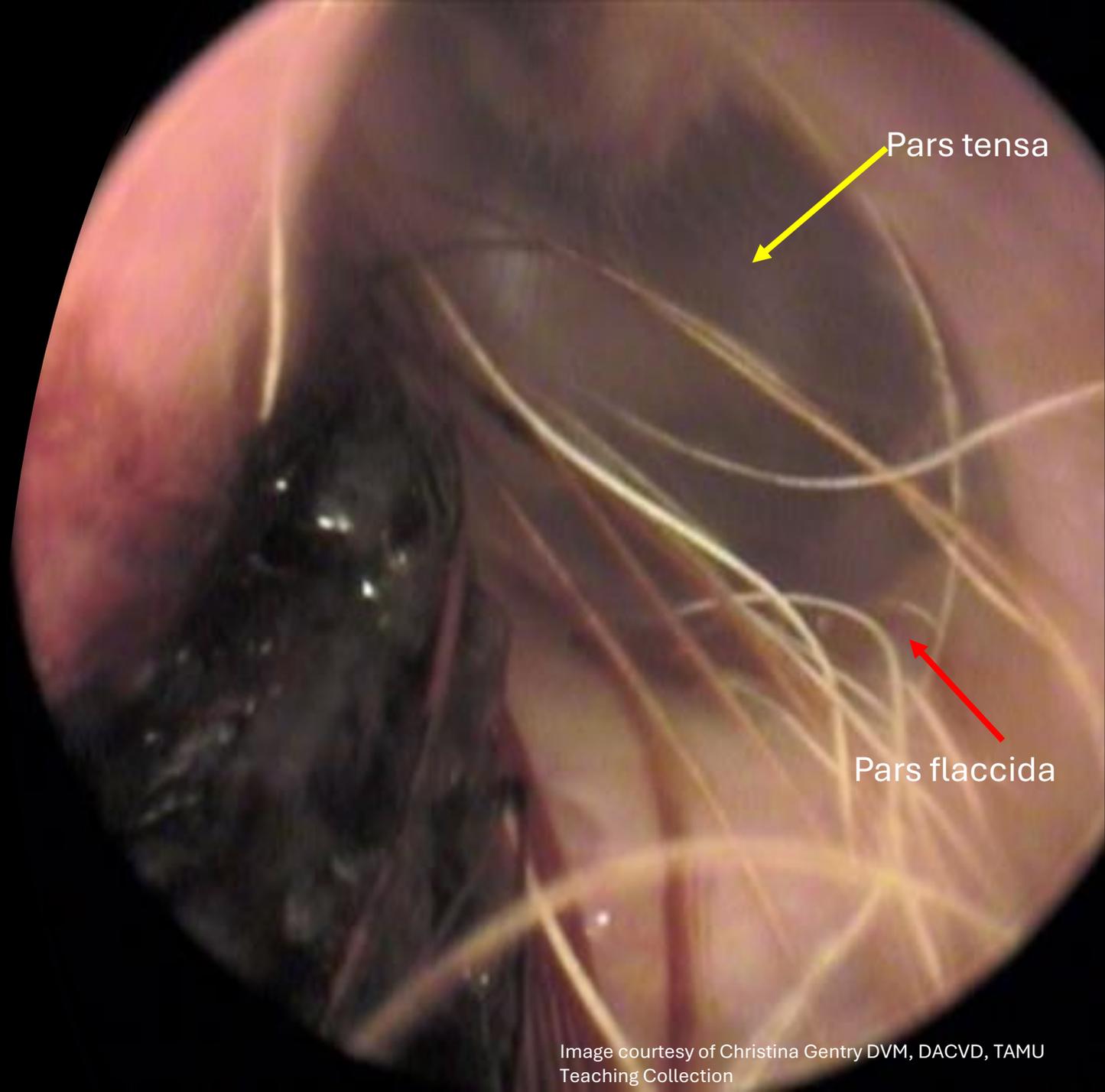
- Safe with ruptured tympanic membrane
- *Pseudomonas aeruginosa* infection
- Known contact hypersensitivity to other topicals

Aminoglycosides

- Contact hypersensitivities (neomycin most commonly)
- Ototoxicity
 - Flush with saline
 - Resolves with time
- Clean ears

Healthy Tympanic Membrane

- **Pars tensa**- thin, fibrous, slight concave shape
- **Pars flaccida**- upper quadrant, ventrally attached to the lateral process of the malleus, opaque, pink, or white in color



Otitis Media

- 16% of acute otitis externa cases
- More common with suppurative inflammation
- +/- Intact tympanic membrane
- Horner's syndrome
 - Head tilt, nystagmus, ataxia, miosis, elevated third eye lid
- Hearing loss
- Systemic and topical medications
 - 6-8 wks and 2 wks past resolution
 - Gold standard- culture middle ear
 - Empiric treatment 5.5 mg/kg orally once daily marbofloxacin
 - Standard dosing in cats

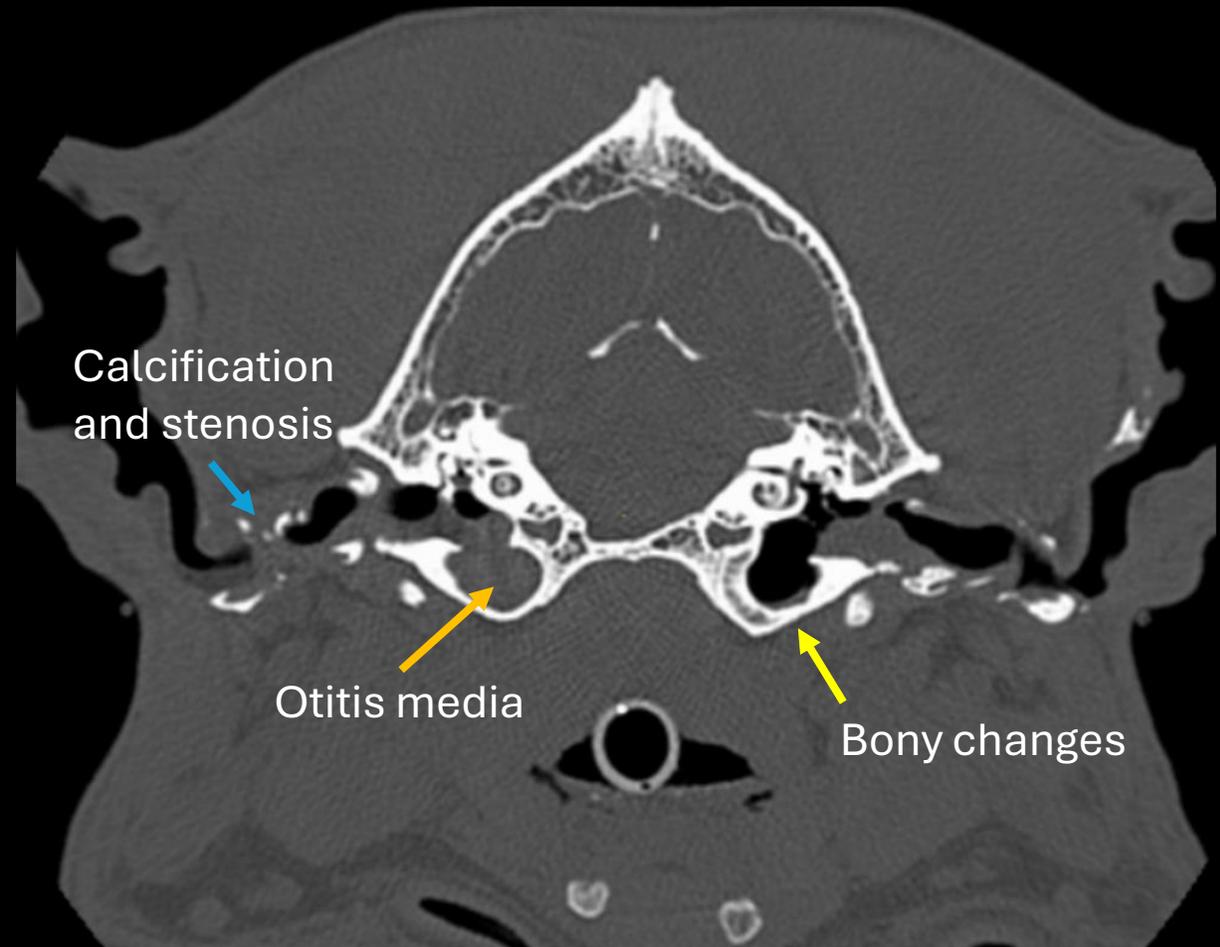


Image Courtesy of Christina Gentry, DVM, DACVD, TAMU Teaching Collection

Source:

1. Bajwa J. Canine otitis externa - Treatment and complications. Can Vet J. 2019 Jan;60(1):97-99. PMID: 30651659; PMCID: PMC6294027.

Long-term Management, Maintenance Phase

At Home Cleaning

Astringents (drying agents)

- **Indications**
 - Post-swimming/grooming
 - Hyperplastic canals
- **Common ingredients**
 - Isopropyl alcohol
 - Boric acid
 - Salicylic acid
 - Keratoplastic, keratolytic >2%
 - Bacteriostatic
 - Keratinization disorders, seborrhea, proliferative ears
 - Acetic acid 2-5%
 - Safe in middle ear
 - Safe following contact hypersensitivities
 - Antimicrobial properties
 - Sulfur
 - Antimicrobial, keratolytic, keratoplastic
 - Keratinization disorders, seborrheic, proliferative ears

Antimicrobials

- **Indications**
 - Mild bacterial and yeast otitis control
 - Prevention/delay of recurrent infections
 - Acidifying
- **Common ingredients**
 - Parachlorometaxylenol (PCMX)
 - Anti-*Pseudomonas*, *Staphylococcus*, *Malassezia* activity
 - Chlorhexidine
 - 1-3% has anti-*Staphylococcus* and *Malassezia* activity
 - Lesser anti-*Pseudomonas* activity
 - Ototoxicity >0.2%
 - Solutions that are low pH

Sources:

1. Nuttall T, Cole LK. Ear cleaning: the UK and US perspective. *Vet Dermatol*. 2004 Apr;15(2):127-36. doi: 10.1111/j.1365-3164.2004.00375.x. PMID: 15030561.
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3. Harvey BVSc DVD Dip ECVD FSB, R.G., & Paterson, S. (2014). *Otitis Externa: An Essential Guide to Diagnosis and Treatment* (1st ed.). CRC Press. <https://doi.org/10.1201/b16788>.
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5. Scott, D.W., Miller W.H., Griffin, C.E. Dermatologic therapy. In Scott, D.W., Miller, W.H., Griffin, C.E., eds. *Muller and Kirk's Small Animal Dermatology*, Philadelphia: W.B. Saunders, 2001, 207-73.
6. Mansfield PD, Steiss JE, Boosinger TR, Marshall AE. The effects of four, commercial ceruminolytic agents on the middle ear. *J Am Anim Hosp Assoc*. 1997 Nov-Dec;33(6):479-86. doi: 10.5326/15473317-33-6-479. PMID: 9358414.

Study: The susceptibility of *Pseudomonas* spp. isolated from dogs with otitis to topical ear cleaners

- Consistent in vitro efficacy¹:
 - Acetic Acid
 - MOA: intracellular acidification
 - Previously described anti-Pseudomonas activity^{2, 3, 4}
 - Safe in the middle ear⁴
 - Lactic Acid
 - MOA: Reduces pH & disrupts cell membrane of Gram – bacteria⁷
 - Unknown ototoxicity
 - Chlorhexidine
 - MOA: Cell membrane disruption
 - Safe in middle ear at <0.2%^{5,6}
 - BAER testing without threshold evaluations not performed⁶

Sources:

1. Steen, S.I. and Paterson, S. (2012), The susceptibility of *Pseudomonas* spp. isolated from dogs with otitis to topical ear cleaners. *J Small Anim Pract*, 53: 599-603. <https://doi.org/10.1111/j.1748-5827.2012.01262.x>
2. Thorp MA, Kruger J, Oliver S, Nilssen EL, Prescott CA. The antibacterial activity of acetic acid and Burow's solution as topical otological preparations. *J Laryngol Otol*. 1998 Oct;112(10):925-8. doi: 10.1017/s0022215100142100. PMID: 10211213.
3. Griffin, C. E. (1993) Otitis externa and otitis media. In: *Current Veterinary Dermatology* Eds C.E. Griffin, K. W. Kwochka and J. M. MacDonald. Mosby, St. Louis. P 245-262.
4. Rosychuk, R. A. W. (1994) Management of otitis externa. In: *Veterinary Clinics of North America: Small Animal Practice* **24**, 921-952.
5. Merchant, S. R., Neer, T. M., Tedford, B. L., Tewdt, A. C., Cheramie, O. M. & Strain, G. M. (1993) Ototoxicity assessment of a chlorhexidine otic preparation in dogs. *Prog Vet Neurol* **4**, 72-75.
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Management of Primary Causes

- Control inflammation
- Ectoparasite control
- Food trials
- Atopy
- Endocrinopathies
 - Hypothyroidism
 - Hypercortisolism
- Maintenance therapies



Recurrence vs Persistence:

- Are you struggling to clear the infection?
 - Persistence
 - Biofilm, otitis media, resistance, under dosing, compliance
- Coming back quickly within 4-8 weeks if you are certain that otitis externa cleared?
 - Recurrence
 - Otitis media
- Has it been cleared for several months and now this is a new infection?
 - Recurrence
 - Uncontrolled primary factor(s)



Cats Aren't Small Dogs



May develop otitis media without overt otitis externa

Less susceptible to secondary otic infections

More susceptible to ototoxicity?

Aqueous-based medications and gentle cleansers are advised

Otic space-occupying lesions often cause otitis in older patients

Ear mites are more prone to cause ear infections in cats

Source:

1. Kennis RA. Feline otitis: diagnosis and treatment. *Vet Clin North Am Small Anim Pract.* 2013 Jan;43(1):51-6. doi: 10.1016/j.cvsm.2012.09.009

Disclosure:

Catherine Metry is a full-time employee of IDEXX*



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