NAVDF 2025

ORLANDO, FLORIDA |APRIL 27 - 30, 2025

2025 FORUM PROCEEDINGS

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PROGRAM AT A GLANCE

SUNDAY, APRIL 27

17:00 - 19:00	Welcome Reception - Sponsored by Nextmune
19:00 - 20:30	Technicians Meet & Greet
19:00 - 21:00	Pawsitive Impact Charity Reception - Sponsored by Nextmune

MONDAY, APRIL 28

Track	Scientific	Clinical	Wet Lab	Abstracts
07:30 - 08:45	Roundtables			
09:00 - 09:50	Opening Keynote: Dr. Stephen White			
10:00 - 10:50	Sensing Itch in the Skin and Beyond	Diagnosis & Management of Non-inflammatory Alopecia in the Dog	Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 1	
10:00 - 11:00				Resident Abstracts (1)
10:30 - 17:00	Exhibits Hall Open			
10:50 - 11:30	Monday Morning Break and Posters			
11:30 - 12:20	Atopic Itch in Humans	Inflammatory Alopecia in the Dog and Cat	Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 2	
11:30 - 12:30				Resident Abstracts (2)
12:30 - 13:45	Hills Lunch Symposia - Food Features for Skin Health			
12:30 - 14:00	ACVD Mentor Lunch (Invite Only) - Sponsored by Stallergenes Greer			
12:45 - 13:45	Allergen Walk #1 - Sponsored by Stallergenes Greer			

PROGRAM AT A GLANCE

Track	Scientific	Clinical	Wet Lab	Abstracts
14:00 - 14:50	Current Views on the Pathogenesis of Atopic Dermatitis - Part 1	Hairy Hurdles Part 1 - Follicular Anatomy and Tumors	Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 3	
14:00 - 15:00				Resident Abstracts (3)
15:00 - 15:50	Current Views on the Pathogenesis of Atopic Dermatitis - Part 2	Hairy Hurdles Part 2 - Hair Cycle and Non-inflammatory Alopecia	Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 4	
15:00 - 16:00				Resident Abstracts (4)
16:00 - 16:30	Monday Afternoon Break and Posters			
16:30 - 17:20	Panel Discussion: Pathophysiology of Atopic Dermatitis and Pruritus	Farm to Pharma: An in Depth Look at Allergens and their Corresponding Extracts	Residents, Interns & Mentors Meet and Greet	
16:30 - 17:30				Resident Abstracts (5)
17:45 - 19:15	ACVD Members Business Meeting (Invite Only) - Sponsored by CEVA			
19:00 - 23:00	Residents Dinner (Invite Only) - Sponsored by Dechra			
19:00 - 23:00	Orlando Social - Sponsored by Elanco Animal Health			

PROGRAM AT A GLANCE

TUESDAY, APRIL 29

Track	Scientific	Clinical	Spanish/Clinical	Abstracts
06:45 - 07:45	Allergen Walk #2 - Sponsored by Stallergenes Greer			
07:30 - 08:45	Roundtables			
09:00 - 09:50	Measuring MIC and Clinical Breakpoints for Veterinary Antibiotics - Essential to Antibiotic Stewardship	Malassezia Review - Part 1	El Papel del Radiologo en Dermatología Veterinaria	
09:00 - 10:00				Resident Abstracts (6)
10:00 - 10:50	Why Have Susceptibility Testing Breakpoints Changed for Veterinary Antibiotics?	Malassezia Review - Part 2	Radiología y Dermatología: Un Enfoque Colaborativo	
10:00 - 11:00				Resident Abstracts (7)
10:30 - 17:00	Exhibits Hall Open			
10:50 - 11:30	Tuesday Morning Break and Posters			
11:30 - 12:20	Clinical Investigation and Biomarker Discovery in Early Drug Development for Allergic Dermatitis Part 1 - Introduction to Biomarkers and Molecular Advancements	Pitfalls in the Diagnosis of Dermatophytosis	Terapia tópica exitosa: como mejorar los resultados en casos complejos	
11:30 - 12:30				Resident Abstracts (8)
12:30 - 13:45	Elanco Lunch Symposium - More Than Skin Deep: Controlling Parasites That Love to Crash the Party			
12:30 - 13:45	Merck Animal Health Lunch Symposium - The Future of Atopic Dermatitis Management: Insights from Human Health			
12:30 - 13:45	Resident Lunch - Sponsored by Blue Buffalo			

PROGRAM AT A GLANCE

Track	Scientific	Clinical	Spanish/Clinical	Abstracts
14:00 - 14:50	Clinical Investigation and Biomarker Discovery in Early Drug Development for Allergic Dermatitis Part 2 - Biomarkers and Translational Biology in Allergic Dermatitis	Sporotrichosis: Epidemiological and Clinical Approach	¿Los gatos pueden tener alergias? Signos, tipos y tratamientos	
14:00 - 15:00				Original Abstracts (1)
15:00 - 15:50	Defining the Genomic Landscape of Canine Cancers	Sporotrichosis: Clinical Brazilian Perspective	Manejo de Pénfigo Foliáceo Canino en la Práctica Veterinaria: Terapias Efectivas y Avances	
15:00 - 16:00				Original Abstracts (2)
16:00 - 16:30	Tuesday Afternoon Break and Posters			
16:00 - 16:30	Resident Research Awards			
16:30 - 17:20	Advances in the Diagnosis and Treatment of Canine Cutaneous T Cell Lymphoma	Panel Discussion: Emerging Fungal Diseases in Human and Veterinary Medicine	Los 10 si y no de la Otitis externa	
16:30 - 17:30				Clinical Abstracts (1)
18:30 - 23:00	Mite-y Big Shindig - Sponsored by Royal Canin			

PROGRAM AT A GLANCE

WEDNESDAY, APRIL 30

Track	Scientific	Clinical	Emerging	ADVT
07:30 - 08:45	ACVD Resident & Board Breakfast (Invite Only) - Sponsored by Thrive Pet Healthcare			
07:30 - 08:45	Roundtables			
09:00 - 09:50	Food Allergies in Humans Part 1 – Clinical Presentations and Diagnostic Testing	Radiology Meets Dermatology: A Collaborative Approach	Artificial Intelligence in Veterinary Medicine: Fundamentals and Advances - Part 1	Diagnostic Testing in Dermatology DVM Tech
10:00 - 10:50	Food Allergies in Humans Part 2 – Current and Emerging Therapeutics	Radiology's Role in Veterinary Dermatology	Artificial Intelligence in Veterinary Medicine: Fundamentals and Advances - Part 2	Facilitating Food Allergy Diagnosis: A Guide for Veterinary Technicians
10:30 - 14:00	Exhibits Hall Open			
10:50 - 11:30	Wednesday Morning Break and Posters			
11:30 - 12:20	Diet Dilemmas: Interactive Cases with Multiple Diseases	What if it is Lymphoma?	The Future of Veterinary Medicine in a Multicultural World	Fungal Diseases for Vet Techs
12:30 - 13:45	Ceva Lunch Symposium - Atopic Dermatitis Cross Talk: Parallels Across Human Pediatric and Veterinary Patients			
12:30 - 13:45	Farmina Lunch Symposium - Diarrhea, Dysbiosis, and Dysmetabolism: Food Responsive Enteropathy in Dogs			
12:30 - 13:45	AAVD Business Lunch			
14:00 - 14:50	Making Client Communication Easier: Nutrition Mythbusting and Pet Food FAQs	What if it is NOT Lymphoma?	Panel Discussion: How to Practice in a Multi-national World	Climate Change and Allergic Disease

PROGRAM AT A GLANCE

Track	Scientific	Clinical	Emerging	ADVT
15:00 - 15:50	Changing Perspectives in Food Allergy: Are we Cracking the Code?	Dermatopathology for Clinical Dermatologists - Part 1	PendingGPT for DVM: How Language Models are Transforming Veterinary Medicine	Engaging and empowering veterinary technicians in veterinary dermatology - Interactive Session
16:00 - 16:30	Wednesday Afternoon Break			
16:30 - 17:20	Panel Discussion: Food Allergies	Dermatopathology for Clinical Dermatologists - Part 2	AI in Your Practice: Getting Started with LLMs	Radiology for Veterinary Technicians

ROUNDTABLE SESSIONS

MONDAY APRIL 28, 2025

CBD in Veterinary Dermatology	Dr. Andrew Rosenberg	**Bayhill 27**
Client Communication in Oncological Veterinary Dermatology	Dr. Dana Connell	**Bayhill 26**
Feline Dermatology: So Many Challenges, So Few Therapeutic Options	Dr. Jeanne Budgin	**Bayhill 24**
Immune-Mediated Dermal Nodules in Cats and Dogs	Dr. Petra Bizikova	**Bayhill 23**
Radiology in Clinical Dermatology Management	Dr. Agustina Anson and Dr. Ramón Almela	**Bayhill 20**
Skinny Lumps and Bumps - All About Nodular Skin Diseases	Dr. Dominique Wiener	**Bayhill 19**
Healing with HBOT (Hyperbaric Oxygen Therapy)	Dr. Charli Dong	**Bayhill 18**

TUESDAY APRIL 29, 2025

Allergens in Clinical ASIT/SLIT	Dr. Tricia Sowers	**Bayhill 27**
Eosinophilic Dermatosis in Cats	Dr. Mitzi Clark	**Bayhill 26**
Equine Dermatology	Dr. Nicole Heinrich	**Bayhill 25**
Evidence-Based Education: How to Improve Your Teaching Based on the Science of Learning	Dr. Andrea Lam	**Bayhill 24**
Improving Surveillance of Fungal Diseases in Animals and Zoonotic Spread	Dr. Flávia Clare	**Bayhill 20**
What's New in JAK Inhibitors?	Dr. Tom Lewis	**Bayhill 19**

ROUNDTABLE SESSIONS

WEDNESDAY APRIL 30, 2025

AI in Veterinary Medicine	Dr. Neoklis Apostolopoulos and Dr. Zach Meyers	**Bayhill 27**
Client Compliance in Diagnostic Food Trials	Dr. Galia Sheinberg	**Bayhill 26**
Diode Laser in Otology	Dr. Klaus Earl Loft	**Bayhill 25**
Malassezia	Prof. Ross Bond	**Bayhill 24**
Mentorship Strategies for Developing Effective Residency/ Internship Dermatology Programs	Dr. Anthea Schick and Dr. Rebecca Mount	**Bayhill 23**
Residents' Roundtable Discussion	N/A	**Bayhill 20**
To Freeze or Not to Freeze: Current Challenges and Pitfalls of Cryosurgery	Dr. Alberto M. Cordero	**Bayhill 19**

PRESENTATION SCHEDULE

MONDAY APRIL 28, 2025

LOCATION: WINDERMERE BALLROOM Y/Z

09:00 - 09:50	**KEYNOTE** Dr. Stephen White	**Where we've been, where we are, and where we should go with veterinary dermatology (important strides we've made in diagnostics and treatments, and potentially what is next)**

SCIENTIFIC NOTES | LOCATION: WINDERMERE BALLROOM W

10:00 - 10:50	Dr. Brian Kim	**Sensing Itch in the Skin and Beyond**
11:30 - 12:20	Dr. Brian Kim	**Atopic Itch in Humans**
14:00 - 14:50	Dr. Rosanna Marsella	**Current Views on the Pathogenesis of Atopic Dermatitis - Part 1**
15:00 - 15:50	Dr. Rosanna Marsella	**Current Views on the Pathogenesis of Atopic Dermatitis - Part 2**
15:30 - 16:20	Dr. Chie Tamamoto-Mochizuki, Dr. Brian Kim & Dr. Rosanna Marsella	**Panel Discussion: Pathophysiology of Atopic Dermatitis and Pruritus**

CLINICAL NOTES | LOCATION: WINDERMERE BALLROOM X

10:00 - 10:50	Dr. Paul Bloom	**Diagnosis & Management of Non-inflammatory Alopecia in the Dog**
11:30 - 12:20	Dr. Mitzi Clark	**Inflammatory Alopecia in the Dog and Cat**
14:00 - 14:50	Dr. Dominique Wiener	**Hairy Hurdles Part 1 - Follicular Anatomy and Tumors**
15:00 - 15:50	Dr. Dominique Wiener	**Hairy Hurdles Part 2 - Hair Cycle and Non-inflammatory Alopecia**
16:30 - 17:20	Dr.Tricia Sowers	**Farm to Pharma: An in Depth Look at Allergens and their Corresponding Extracts**

PRESENTATION SCHEDULE

MONDAY APRIL 28, 2025

WET LAB *(ADDITIONAL COST TO ATTEND)* **| LOCATION: REGENCY BALLROOM V**

10:00 - 10:50	Dr. Allison Kirby & Dr. Alberto Martin Cordero	**Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 1**
11:30 - 12:20	Dr. Allison Kirby & Dr. Alberto Martin Cordero	**Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 2**
14:00 - 14:50	Dr. Allison Kirby & Dr. Alberto Martin Cordero	**Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 3**
15:00 - 15:50	Dr. Allison Kirby & Dr. Alberto Martin Cordero	**Freeze! Practical Cryosurgery for Dermatologic Lesions - Part 4**

PRESENTATION SCHEDULE

MONDAY APRIL 28, 2025

RESIDENT ABSTRACTS | LOCATION: REGENCY BALLROOM T, CONVENTION LEVEL

10:00 - 10:15	Dr. Geishly Cruz Matos	**An alternative staining technique for cytology**
10:15 - 10:30	Dr. K. Helena Montin Mills	**Multidrug-resistant bacteria isolated from canine skin infections across receiving services at the University of Minnesota Veterinary Medical Center: a retrospective study**
10:30 - 10:45	Dr. Lucy Tongen	**Effect of 72-hour transport delay of aerobic bacterial cultures to a reference laboratory on the Staphylococcus species isolated from canine pyoderma**
10:45 - 11:00	Dr. Jennifer Clegg	**Duration of antibiotic therapy for canine superficial pyoderma: Is the one-week post resolution of clinical signs a valid rule-of-thumb?**
11:30 - 11:45	Dr. William Byun	**Curcumin decreases β-lactam resistance against canine meticillin-resistant Staphylococcus pseudintermedius; an in-vitro study**
11:45 - 12:00	Dr. Samuel Devine	**In vitro evaluation of the antimicrobial activity of retinaldehyde against clinical isolates of Staphylococcus pseudintermedius and Malassezia pachydermatis**
12:00 - 12:15	Dr. Kain Masutani	**Alcohol is the cure: Topical ethyl alcohol as a novel treatment for superficial bacterial pyoderma in dogs**
12:15 - 12:30	Emily Binversie	**Preliminary in vitro Antimicrobial Evaluation Against Staphylococcus pseudintermedius and the Lathering Ability of Currently Available Chlorhexidine-Containing Shampoos on the U.S. Market**
14:00 - 14:15	Mr. Oscar Ramirez	**A preliminary study investigating a multidimensional pruritus scoring system, the 5-D itch scale, for assessment of pruritus in dogs with atopic dermatitis**
14:15 - 14:30	Dr. David Birchler	**Evaluation of agreement between a novel veterinary molecular diagnostic serological allergen test (Pet Allergy Xplorer), conventional extract-based serological allergen test (Stallergenes Greer Laboratories, Idexx) and intradermal allergen test in 33 dogs with atopic dermatitis**

PRESENTATION SCHEDULE

MONDAY APRIL 28, 2025

RESIDENT ABSTRACTS | LOCATION: REGENCY BALLROOM T, CONVENTION LEVEL

14:30 - 14:45	Dr. Aubrey Gould	**Influence of maropitant citrate on intradermal test reactivity in atopic dogs**
14:45 - 15:00	Dr. Callie Miller	**Staphylococcus pseudintermedius, Staphylococcus aureus, and Malassezia pachydermatis reactivity on intradermal allergy testing in atopic dogs**
15:00 - 15:15	Dr. Caroline Williams	**Use of the Health Belief Model to assess factors associated with owner persistence to allergen-specific immunotherapy recommendations**
15:15 - 15:30	Dr. Tricia Daniels	**Identifying inflammatory γδ T cells in skin of atopic dogs using RNAscope**
15:30 - 15:45	Dr. Marlyse Wehber	**Adverse events and clinical efficacy of oclacitinib in cats: a retrospective analysis**
15:45 - 16:00	Dr. Jenifer Baker	**Prevalence of keratoconjunctivitis sicca in dogs diagnosed with atopic dermatitis**
16:30 - 16:45	Dr. McKenna Snidow	**Stability and minimum inhibitory concentrations of compounded ceftazidime in sodium chloride, glycerin, and dexamethasone-SP solutions stored at –20°C, 4°C, and 25°C over a 60 day period**
16:45 - 17:00	Dr. Shae Atterberg	**Evaluation of compatibility and stability of compounded otic solutions containing enrofloxacin over a 20-day period**
17:00 - 17:15	Dr. Danielle Nolitt	**Suppurative Malassezia otitis externa: a descriptive retrospective analysis**
17:15 - 17:30	Dr. Shahleen Ahmed	**Practitioner-reported diagnosis and awareness of coccidioidomycosis in dogs from non-endemic states, 2013-2023**

MONDAY, APRIL 28, 2025 | 2:00 PM

Pathophysiology of Atopic Diseases in Veterinary Medicine (Part 1 and Part 2)

ROSANNA MARSELLA, DVM, DACVD

University of Florida

Much progress has been made in recent years regarding our understanding on the pathogenesis of atopic diseases in animals. As we learn more about it, we are able to draw ***comparisons between species:*** we can observe the striking similarities and some of the differences that exist across species and these findings help us to further our understanding on atopic disease overall.

In general, allergic diseases have become more common in the last few decades in both people and animals and many theories have been proposed to explain this increase. While atopic diseases are the results of interaction between ***genetic factors*** and ***environmental conditions***, genetics alone cannot explain the increased frequency of development of atopic disease. Thus, a lot of effort has been focused on the effect of environmental factors that play a role in disease development and how these factors have changed in the last few decades.

Our living conditions have dramatically changed, not just in terms of increased consumption of ultraprocessed foods, increased use of antibiotics and decreased exposure to beneficial bacteria due to life style and dietary exposure. We are also chronically exposed to a variety of chemical insults ranging from detergents, to microplastics, nanoparticles which damage our epithelial barriers promoting inflammation and promote a Th2 response. Epithelial barriers are important borders between the host and the environment. Homeostasis is vital for a healthy barrier, a biodiverse microbiome, and regulatory immune response. When our barriers (from skin to gut and respiratory tract) are chronically exposed to insults that physically and chemically damage their integrity, inflammation and dysbiosis occur leading to development of an inflammatory/allergic response, increased penetration of allergens and establishment of a self-perpetuating cycle of inflammation.

The hygiene theory which had placed emphasis on the decreased exposure to bacteria as a primary cause for the increased development of atopic disease. Beneficial bacteria have been shown to be important for a variety of reasons such as shaping the immune response toward tolerance, contributing to bacterial biodiversity thus fighting dysbiosis and the development of chronic inflammation. The role for beneficial bacteria has been investigated in dogs and to lesser degree in cats. In dogs, there is evidence of decreased

skin biodiversity in atopic subjects, which correlates with the severity of the dermatitis. As the animal undergoes an active flare, Staphylococcus predominates in the skin, driving the inflammation and worsening the skin barrier function by increasing the pH and increasing the permeability. In cats, much less is known but it appears that healthy feline skin predominant species of Staphylococcus is S. epidermidis while S. capitis is the predominant species in allergic cats. The decreased biodiversity is not just in the skin but also in the gut. Gut dysbiosis has been documented in allergic dogs and this seems to be a signature of atopic dermatitis in dogs, as this dysbiosis does not change significantly as the animal undergoes treatment (as opposed to the skin dysbiosis where the biodiversity increases as the animal undergoes treatment and the severity of the dermatitis improves). The value of probiotics is recognized in dogs and cats. The benefits range from shaping the immune response and cytokine profile to increasing the biodiversity thus minimizing dysbiosis and inflammation. Dysbiosis in atopic disease in horses is less documented but we know that horses with pastern dermatitis has dysbiosis and increased preponderance of Staphylococcus, proportional to the severity of the disease.

The increased use of ultra-processed foods and decreased exposure to farm life have been documented as associated with development of atopic disease in dogs and people. Dogs fed raw diets or homecooked whole food diets were found to be less associated with development of atopic disease compared to dogs living in apartments and fed ultra-processed food. These factors may play a role in affecting the bacterial biodiversity when exposure to non-pathogenic bacteria is facilitated shaping the immune response toward tolerance.

What has also changed in the last few decades is the exposure to pollutants and chemicals that can damage epithelia. These factors set the stage for the development of chronic inflammation and increased epithelial permeability and increased immunologic exposure to allergens. This negative impact is not just on the skin but also on the gut and on the lungs. Pollutants have been demonstrated to physically and chemically damage epithelia and alter the immunologic response decreasing tolerance and promoting Th2 responses.

The role of epithelial impairment on development and progression of disease is well documented in people. Within domestic species, the species that has been studied the most is the dog. Canine atopic dermatitis has many similarities with the human condition both in terms of clinical signs and pathogenesis of disease, the role that skin barrier and the impact that changing living conditions play in the disease. These similarities make dogs the best model for the human condition as dogs replicate the complexities of the human disease and share the same environment of people. In the past we have looked at skin barrier impairment as either due to genetic mutations (primary) or secondary to allergic inflammation. Skin barrier impairment has been documented in canine atopic dermatitis but the evidence of genetically inherited mutations as major risk factors for development of canine atopic dermatitis is missing. While in human medicine, filaggrin

has been documented to be a major risk factor, the same may not be true in dogs, at least with the current level of information. Filaggrin mutations appear to be breed dependent and only in some geographical areas.

Skin barrier impairment increases the ease of sensitization in experimental models of canine atopic dermatitis and allergen challenges lead to temporary worsening of skin barrier. So, there is no argument that inflammation worsen skin barrier function. Now it is recognized that environmental factors such as pollution can dramatically damage epithelia and increased permeability thus facilitating the development of atopic disease and that skin barrier damage can be an initiating factor for atopic disease in the absence of a genetic mutation.

Exposure to pollutants has been linked to atopic dermatitis in dogs and people. A study showed that a significant association between high levels of passive exposure to tobacco smoke (cigarette consumption divided by the area of the home) and the presence of atopic dermatitis in the dogs. Results lead to the conclusion that high level of exposure to tobacco smoke may have higher risk of atopic dermatitis than non-exposed dogs.

How pollutants can predispose to development of the disease is on multiple fronts, from epigenetic changes that decrease tolerant response and promote TH2 response, to damage to the epithelia to interfering with lipid metabolism. Pollutants generate reactive oxygen species leading to directly damage membrane lipids and increase lipid peroxidation. A study has reported significant correlation between severity of dermatitis and plasma malondialdehyde and higher levels were found in atopic dogs compared to normal dogs. The significant, highly positive correlation determined between severity of dermatitis and malondialdehyde in the patient group indicates an association between the severity of canine atopic dermatitis and the extent of oxidative damage to membrane lipids.

Other living conditions have changed in the decades or so. One is life style that is prone to increase stress. Stress and atopic dermatitis has been investigated in people and to lesser degree in dogs. With stress and atopic dermatitis, the question is which starts first…the chicken or the egg? In people prolonged stress is seen as a potential trigger for atopic dermatitis as well it is recognized that atopic people's quality of life is affected leading to stress and a vicious cycle of exacerbation of the disease. . We lack these types of studies in dogs but we know that dogs diagnosed with atopic dermatitis have impairment of their quality of life due to chronic pruritus and that there is a correlation between the cortisol level in the hairs of these patients and their level of pruritus. We also know that dogs with atopic dermatitis have higher levels of cortisol in the hair compared to healthy controls. As far mechanisms on how stress can actually lead to development of atopic dermatitis, we know that cortisol affects skin barrier function. Stress leads to cortisol release which negatively impact epidermal lipid and structural protein synthesis, decreasing stratum corneum hydration and increasing Trans Epidermal Water Loss.

To make things even more complex is the consideration that atopic dermatitis may be primarily a lipid disorder evolving into a chronic inflammatory disease, possibly due to changing environmental conditions. While a lot of the emphasis has been placed on atopic dermatitis as an outsde/in disease, it is important to note that lipid differences exist both in the skin and in the blood of allergic dogs compared to normal supporting differences in lipid metabolism. These finding suggest that canine atopic dermatitis is a systemic disease. Growing amount of literature is available on atopic dermatitis as a systemic disease of lipid metabolism is available in human medicine.

Glycerophospholipids are fundamental for lipid membrane stability and dynamics. More specifically, phospholipids are known were found to be increased in the skin but reduced in blood from atopic dermatitis dogs. Lipid changes in atopic dogs are known to occur independently of inflammation and trauma from scratching. The systemic changes in lipid composition of blood and skin may affect the barrier function of the epidermis

In one study, a set of lipid features of the skin was selected as a biomarker that classified samples as control or atopic dermatitis with 95% accuracy, whereas blood lipids discriminated between control and atopic dogs with 90% accuracy. These data suggest that canine atopic dermatitis is a systemic disease and support the use of rapid lipid profiling to identify novel biomarkers.

In conclusion, much progress has been made in recent years on our understanding of pathogenesis of atopic disease. Animals and people share out living conditions, not simply because pets are in our homes and share the same allergenic exposure, but more broadly because we are exposed to the same pollutants and chemicals which are unavoidable and which can majorly affect our epithelial barrier and out ability to respond to allergen and other external insults. All these factors shape our immune response, affect our microbiome and the type of response that we build to our allergen exposure.

Selected references

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MONDAY, APRIL 28, 2025 | 10:00 AM

Diagnosis & Management of Non Inflammatory Alopecia In the Dog

PAUL BLOOM, DVM, DACVD, DABVP (CANINE AND FELINE SPECIALTY)

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Allergy, Skin and Ear Clinic for Pets, Livonia, MI

Alopecia in the dog is a common clinical finding. It is most commonly associated with pruritus due to allergic skin disease. There are also many causes of nonpruritic alopecia[i,ii,iii,iv] vaccine-induced alopecia is most commonly associated with rabies vaccination. The alopecia occurs 2-12 months after administering a rabies vaccine. Small white breeds of dogs seem to be at risk for developing these lesions. SQ or IM injections have no impact on the occurrence of this reaction. Lesions consist of scaling, focal (occasionally multifocal) areas of alopecia, plaques, hyperpigmentation, nodules, erosions, crusts, and cutaneous atrophy (scarring). The lesions may also develop at sites distant from the vaccination site. Histologically in addition to typical vasculitis changes, septal panniculitis and focal lymphoid nodules will be seen. Rule-outs are fairly limited but should include demodicosis, dermatophytosis, allergic skin disease, and bacterial skin disease.

Dermatomyositis a genodermatosis in collies and shelties, or it may occur spontaneously in adults of other breeds. For the inherited form the age of onset is between 6 weeks and 1 year of age- usually before 6 months of age. The lesions may be fairly limited and heal as the puppy matures or they may progress. Usually, the lesions stop progressing by the time the dog is a year old. The cutaneous lesions, which are usually the predominant clinical sign, include focal to multifocal areas of alopecia, scaling, crusts, erosions, ulcers, depigmentation, hyperpigmentation, and scarring. These lesions occur on the face, mucocutaneous junctions, carpal, and tarsal regions, and the tip of the tail and ears. Onychodystrophy may also be present. Secondary bacterial pyodermas may occur. Muscle involvement tends to be proportional to the severity of the skin lesions and is usually identified after the cutaneous lesions develop. These dogs may develop megaesophagus or muscle atrophy involving the muscles of mastication and ambulation. Differential diagnoses for the skin disease include demodicosis, dermatophytosis, superficial bacterial folliculitis, DLE, cutaneous drug reaction, erythema multiformae,and epidermolysis bullosa simplex. In the author's experience, puppies are most commonly presented with limited facial lesions that the breeder claims are wounds/scars from the other puppies or a cat in the household. Diagnosis is based

on signalment, physical examination, and histopathologic changes consistent with vasculopathy.

Treatment for these ischemic skin diseases would include avoiding the trigger (vaccines in the former and removing the dog from the breeding stock in the latter) however for all forms the treatment will include sunlight avoidance, vitamin E (should be D alpha-tocopherol, not DL alpha-tocopherol) 400-800 IU bid) and Essential Fatty Acids and pentoxifylline and various immunomodulating drugs[v]. For vaccine-induced alopecia, the treatment options include pentoxifylline or surgical excision of the affected area. Pentoxifylline is a methylxanthine derivative that increases RBC deformability and lowers blood viscosity, allowing better blood flow through narrowed/edematous vessels. It also suppresses the synthesis of proinflammatory cytokines such as IL-1, IL-4, IL-12, and TNF-α. Pentoxifylline is administered at 15 mg/kg tid. There may be a 30–90-day lag before the full clinical response is seen. For dermatomyositis, the treatment will depend on the severity of the symptoms. The author treats dermatomyositis with. neutering. In the past if the dog was moderately affected, then tetracycline and niacinamide would be used along with pentoxifylline. Once again the author discontinued prescribing doxycycline/niacinamide (D/N) for this group of diseases except in rare situations. If there are focal lesions topical glucocorticoids (GC) may be used. The most potent topical GC (veterinary product) is a product containing fluocinolone acetonide (Synotic). If the local disease is not adequately controlled using Synotic, the author uses an even more potent product containing desoximetasone – at a concentration of 0.25%. These topical products are applied bid until clinical remission (not to exceed 21 days) and then tapered slowly over the next few months. Be sure to have the owners wear gloves when applying these products. Please note that topical steroids may cause PU/PD/polyphagia and skin fragility. This sensitivity to steroids is quite variable and may occur in unexpected situations. Topical tacrolimus (0.1%) may be used in cases that fail to respond to topical steroids, the pet has side effects to the topical steroid, or the dog needs long-term topical treatment to control the disease. If not responding to topical treatment then oclacitinib may be added to the treatment. It is administered at 1.0 mg/# bid for up to 30 days and then attempt to taper. If the patient is in remission (i.e., any crusts are in the hair coat or are easily removed from the skin and all ulcers are healed) after 30 days, the author decreases the frequency to once every 24 hours for 30 days, then decreases to every other day for 30 days, then ceases treatment. If treatment every 12 hours for 30 days is ineffective, oclacitinib is discontinued and glucocorticoids dispensed. If clinical relapse occurs during an immunosuppressant taper, the medication should be increased to the last effective dosage and frequency. Depending on the dose of the other medications that may be used, long-term administration of oclacitinib bid may not be the best option because of potential side effects (anemia, leukopenia) If the disease is more widespread and fails to respond to the previous

treatments, prednisone may be used. It is administered at 1.0 mg/# bid x 4 then ½ mg/# bid for 10 days. The dog is rechecked every 14 days. Note that some dermatologists report successful responses to using prednisolone/prednisone at anti-inflammatory doses (0.25 mg/# bid x 14 days then taper). If the disease is in remission, the dose is decreased by 25% every 14 days. The author defines "remission" as the absence of any active lesions. DON'T TAPER THE DOSE TOO QUICKLY. The goal is to maintain the dog on 0.25 mg/# or less every other day. If unable to decrease the prednisone to 0.25 mg/# or less every other day, then additional immunosuppressive agents need to be added. Historically the author would use azathioprine as the first steroid-sparing agent in DOGS. The initial dose of azathioprine is 1.0 mg/# sid- note that there is a 4–6-week lag effect. Once remission is achieved, and the dog is either off of GC or the lowest dose of GC has been obtained, AZA is then tapered, also every 14-30 days. Usually, the author will decrease the frequency, not the dose of azathioprine, first decreasing it to every other day and then if the disease is still in remission, to every 72 hours. A CBC, platelet count, serum chemistry profile are performed every 14 days for 2 months, then q 30 days for 2 months then q 3 months for as long as the dog is on azathioprine. Potential adverse effects include anemia, leukopenia, thrombocytopenia, hypersensitivity reactions (especially of the liver), and/or pancreatitis. More recently the author has been using mycophenolate instead of AZA because of fewer side effects, less monitoring and it is a less costly drug. The starting dose is 10-22 mg/kg bid. The most significant SE is severe diarrhea so it is best to start at the lower end for a few weeks and then if tolerated and needed increase the dose. Note that myelosuppression may occur so a baseline cbc and serum chemistry profile followed by a CBC at 30 days and then cbc and serum chemistry profile q 6 months is reasonable

If the dog fails to respond to AZA/mycophenolate, then chlorambucil may be administered at 0.2 mg/kg sid. Like AZA there is a lag effect and potential effects on the bone marrow so monitoring bloodwork as you do w/AZA would be prudent. Cyclosporine (Atopica®) may be effective in some cases. Be sure to use modified cyclosporine since unmodified CSA is not absorbed as well. The dosage is 5 mg/kg sid. Sulfasalazine (SSZ) may be used if all other drugs fail. It is sulfa that has both anti-inflammatory and/or immunomodulatory properties due to its prostaglandin synthetase and leukotriene inhibition. In the past, it has been used for the treatment of colitis but more recently it has been used for neutrophilic vasculitis. SSZ is metabolized by colonic bacteria to 5-aminosalicylic acid (5ASA) and sulfapyridine (SP). SP is well absorbed, metabolized in the liver, and excreted by the kidney while 5-ASA is much less well absorbed. Because SSZ is metabolized to aminosalicylic ("aspirin") this drug should be used cautiously in cats. The biggest concern with this medication is the possibility of developing irreversible kerato-conjunctivitis sicca. This appears to be an idiosyncratic reaction that occurs more in smaller dogs but may occur in any dog. It is essential that you warn the owner that if the eyes become red or they notice an ocular discharge or squinting to contact you immediately so that you can do tear testing. Other side-effects associated with this drug

include anemia and hepatotoxicity so a CBC, serum chemistry profile, and Schirmer tear test are performed every 14 days for 2 months, then q 30 days for 2 months then q 3 months for as long as the dog is on SZA. The dose is 20-50 mg/kg tid (maximum 1 gm/dose), usually beginning with 20-30 mg/kg tid. Once the disease is in remission, the dose is slowly tapered

Sebaceous adenitis (SA) is an inflammatory disease of the sebaceous glands. Some people will separate this disease into the granulomatous form (Standard Poodle form= SPf) that is seen in Standard Poodles, Akitas, Samoyeds, Old English, and Belgian sheepdogs and the short-coated breed form seen in the Vizsla, Weimaraner, and Dachshunds. The author believes this latter form is not sebaceous adenitis but rather part of the syndrome known as sterile granuloma/pyogranuloma syndrome (sterile periadnexal granulomatous dermatitis) and will not be discussed in this lecture. A genetic basis has been identified in Standard Poodles and is believed to be an autosomal recessive trait. Both forms of the disease occur in young adult to middle-aged dogs. Clinically the dog with the SPf will have adherent white scaling, follicular waxy “casts”, and matted hair from the waxy scale, varying degrees of hypotrichosis (including alopecia), and a dull appearance to the hair coat. When follicular casts are found on examination rule outs should include sebaceous adenitis, superficial bacterial folliculitis, demodicosis and dermatophytosis. Recently it has been described that dogs with SA showed a thinner lacrimal lipid layer and more severe meibomian gland (are a type of sebaceous gland) abnormalities than control dogs, which seemed to progress with age. Some ophthalmologists recommend that ophthalmic examinations be performed even in the absence of owner-reported
ocular signs

In Standard Poodles, many of the remaining hairs lose their curls. Secondary bacterial folliculitis may be present and result in pruritus. SPf tends to begin on the dorsum, especially the head, and then progress caudally and distally onto the extremities. In the short-coated form, there are multifocal areas of annular alopecia with scaling that involves the trunk and may be a different disease (granuloma/pyogranuloma syndrome) . Early histopathologic changes that are found with the granulomatous form include a nodular granulomatous to pyogranulomatous reaction in the ischemic region of the hair follicle that is unilateral (sebaceous glands are unilateral), follicular and surface hyperkeratosis (clinically will appear as scaling). In the end-stage of the disease, the inflammation has resolved, and you will be left with perifollicular fibrosis, follicular atrophy, and the absence of sebaceous glands. Treatment for the SPf is to treat secondary bacterial or Malassezia infections, remove the dog from breeding stock, pre-bath spraying with baby oil, bathing with a keratolytic shampoo (e.g., sulfur/salicylic acid-containing product) and follow with a humectant. Keratolytic agents will cause desquamation of the cornified epithelium, basically loosening the outer layer of the skin (SC). Oral omega 3/6 combination products at double the bottle dose, evening primrose

oil (500 mg bid), are commonly prescribed by the author. In a recent study oral cyclosporine was used in 12 dogs with SA (not just SPf). Ten of twelve dogs improved within 4 months however most needed topical therapy once the mCSA was discontinued. The author concluded that long-term treatment appears to be necessary to control the disease. Also reported is the topical administration of CSA (in 1 study 0.4% in vegetable oil and the other 1% in oil) daily. In both these reports, there was a significant improvement in the dog's clinical appearance. In the 1 case that the author has used the 1% spray (25 ml CSA in 250 ml oil) along with w/bathing there was dramatic hair regrowth.

The next group of alopecic diseases that will be discussed are the ones that are diffuse or symmetrical on examination. The first group we will discuss is endocrinopathies[vi]. Hypothyroidism is one of the most over-diagnosed endocrine diseases in the author's referral practice. Hypothyroidism is most commonly caused by an immune-mediated destruction of the thyroid gland.[vii] Middle-aged medium-sized to large breed dogs are the most commonly affected dogs. Clinical findings that have been associated with hypothyroidism are quite extensive and will not be reviewed here. A few dermatologic clues would include seborrhea sicca or oleosa, poor hair regrowth (seems to be a more common complaint than spontaneous alopecia), recurrent bacterial pyoderma, and a dry, dull hair coat. Alopecia (triangular in shape) just caudal to the nasal planum is another finding that suggests hypothyroidism. The "frizzies" may be seen in Golden retrievers and Irish setters. CBC, serum chemistry profile and a urinalysis may reveal mild nonregenerative anemia, hypercholesterolemia, and hypertriglyceridemia. Thyroid testing is needed for a definitive diagnosis of hypothyroidism. Thyroid tests that are of value include Total T4 (TT4), free T4 by equilibrium dialysis (fT4ed), thyroid-stimulating hormone concentrations (cTSH), thyroglobulin autoantibody (TgAA), T4 autoantibodies (T4ab), and T3 autoantibodies (T3ab). Details of these tests sensitivity and specificity are beyond the scope of this lecture.

The thyroid profile requested by the author includes TT4, cTSH, TgAA, T4ab, T3ab. The author will have a fT4ed added to the profile if there are T4ab present if non-thyroidal illness is present or the dog has received drugs known to affect the thyroid. In general, DOGS MUST NOT HAVE RECEIVED TOPICAL OR ORAL STEROIDS FOR 30 DAYS OR REPOSITOL STEROIDS FOR 3 MONTHS BEFORE TESTING THE THYROID. Also, they must not have received sulfa drugs for at least 30 days. For dogs with hypothyroidism, after 1 month of therapy (L-thyroxine 0.02 mg/kg bid-use BRAND NAME ONLY), a blood sample is submitted 4-6 hours post-pill for a TT4. The levels should be in the upper range of normal or even a little higher than normal.

A far more common endocrinopathy seen by the author is hyperadrenocorticism (HAC). It is not the purpose of this lecture to discuss all the symptoms of HAC, but a few points must be made. In dermatology, it is NOT uncommon to have a dog with HAC present without PU/PD or a potbelly appearance and may ONLY have a recurrent pyoderma,

poor hair regrowth, or non-inflammatory truncal alopecia. If there is a suspicion that the dog may have an endocrinopathy (based on PE, CBC, serum chemistry, and urinalysis results) then it is important to first rule out HAC since a dog with HAC may have a low thyroid profile due to the influence that steroids have on the thyroid gland. The 2 screening tests that are used by the author are the ACTH stimulation and the LDDS. If the dog has a history of steroid exposure, then an ACTH stimulation test is performed. If the dog has no recent steroid exposure, then the author prefers to begin with a LDDS test. Note that 1 normal screening test doesn't rule out HAC. The author believes that the sensitivity of the LDDS is much better than the ACTH stimulation. Treatment for HAC is based on the severity of the clinical signs. Either trilostane or mitotane may be used for treatment.

Dyscyclic follicular diseases (syndrome?) of unknown etiology have a variety of names depending on the breed (post clipping alopecia, alopecia X, seasonal flank alopecia.) they are all diseases in which the hair follicle is structurally normal but it is not cycling properly.[viii,ix,x] Rule-outs for these dyscyclic diseases include the endocrinopathies already discussed and also hyperestrogenism (Sertoli cell tumor-associated). So, if it isn't an endocrinopathy or hyperestrogenism we are dealing with this syndrome. I will discuss the different types that are reported but it is easier just to think of them all as part of the same disease process. No one therapy is effective for any of the listed syndromes, and it is the author's opinion that we need to be sure that the therapy is not worse than the disease (e.g., using lysodren to treat Alopecia X!)

Alopecia X is a syndrome of unknown etiology. Theories abound as to the cause including an adrenal sex hormone imbalance, an abnormal metabolism of hormones by the hair follicle, or a hormone receptor problem at the follicular level. The latter theory is supported by the observation that hair regrows at the site of skin biopsies. This ability to induce hair regrowth by localized trauma would suggest a local inhibition of hair cycling rather than systemic. Alopecia X occurs in plush-coated breeds and poodles. It occurs in young adults of either sex or reproductive status. Clinically these dogs lose their guard hairs, beginning on the neck and progressing to the shoulders, trunk, and thighs. Eventually, the dog may have a woolly, cream color coat. In some dogs, this may progress to alopecia with hyperpigmentation. Diagnosis is based on signalment, hx, PE, and ruling out (r/o) other alopecic diseases. Histopathology can support but not diagnose Alopecia X. That is because the findings with Alopecia X resemble other dyscyclic alopecic diseases such as hypothyroidism, hyperadrenocorticism, gonadal sex hormone abnormalities, recurrent flank alopecia, and post clipping alopecia. Histologically, these diseases are characterized by many specific (follicular atrophy, telogenization of follicles with excessive trichilemmal keratinization (flame follicles), orthokeratotic hyperkeratosis, follicular keratosis, sebaceous gland atrophy), but nondiagnostic (non-differentiating) findings. An adrenal sex hormone panel stimulation test can be performed but it is of questionable value in the author's opinion. Treatments

that have been used with variable success include neutering, sex hormone replacement (estrogen OR testosterone), low dose lysodren, trilostane, growth hormone, and thyroid supplementation. All of these treatments may cause a temporary improvement in the alopecia (nonspecific anagen induction?) but rarely is the hair coat returned to normal. Also, these medications (other than melatonin) are associated with potentially significant side effects. In the author's practice, if a diagnosis of Alopecia X is made then the client is counseled about the choice in treating a cosmetic disease with potent drugs. Neutering is recommended if it is an intact animal. If the alopecia fails to respond to the neutering, a therapeutic trial with melatonin 3-6 mg tid for 90 days is performed or Dermatonin Implants - dogs < 25 lbs: 8.0 mg every 6-9months; 25-50 lbs: 12.0 mg; >50 lbs: 18.0 mg melatonin implant every 6-9 months.[xi]

Seasonal flank alopecia (SFA) is a nonscarring alopecia that has been reported in a variety of breeds, but it has been reported to be more common in Boxers, Airedales, and Bulldogs. The etiology is unknown. Some people think that it is caused by a "melatonin deficiency" since many of the dogs develop the lesions in the fall, when melatonin levels should be increasing, and some dogs respond to melatonin administration. But there are some cases that the hair is lost in the spring and regrows in the fall so it makes this etiology impossible. The disease occurs in young adult dogs and will begin most commonly in the fall with spontaneous resolution in the spring. This disease may occur once and never recur, it may recur each year with each episode involving larger areas of the body, or it can occur once and never completely resolve. The lesions involve the flanks and sometimes the caudal lateral thorax. The alopecia is usually bilateral with annular lesions that may coalesce into polycyclic lesions with hyperpigmented and smooth glistening skin. Papules and pustules consistent with a bacterial pyoderma may develop in these areas. Diagnosis is based on r/o other nonscarring alopecias – history alone may be diagnostic if it is a recurrent problem. A biopsy can support but not diagnose SFA. Treatment is again either a tincture of time or melatonin. Since the disease usually goes into spontaneous resolution it may be difficult to determine if the melatonin had any impact, especially the first time the disease occurs. In the author's practice, melatonin is more commonly used to prevent symptoms by beginning therapy just before the onset of the symptoms (if there is a seasonal pattern). The dose is as discussed previously.

Post-clipping alopecia occurs primarily in the Arctic breeds. It has been theorized that these breeds have a very long telogen (resting) phase to their hair cycle to preserve a high protein substance (hair!). If the hair is clipped during the telogen stage, it will not regrow until it cycles back to the anagen stage. Others have suggested that when the hair is clipped there is decreased blood flow to the area (to minimize heat loss) leading to a decrease in growth factors. Diagnosis is based on hx and r/o endocrinopathies. Histopathology will reveal follicles of normal size but in most are in telogen. Treatment is

tincture of time or sometimes a 7–10-day course of thyroid supplementation (will stimulate anagen formation) or a 90-day trial of melatonin

The structural follicular dysplasias -color linked, non-colored linked and pattern baldness all have an abnormality not just of the hair follicle but also the hair shaft. Be aware that finding dysplastic hair follicles on histopathologic is not adequate evidence to diagnose a structural follicular disease; there should also be dysplastic hair shafts. A study in 1998 reported that 46% of the dogs with an endocrine alopecia had dysplastic hair follicles but less than 1% had concurrent dysplastic hair shafts.

Colored linked alopecias include color dilution (mutant) alopecia (CDA) and black hair follicular dysplasia (BHFD). CDA occurs in dogs with a blue or fawn hair coat. These hair coat colors occur as a result of the effect of the "dilute" gene on black or brown hairs respectively. Any dog with a blue or fawn coat may be affected by CDA but not always. Dobermans and Great Danes are the most common breeds seen in the author's practice affected by CDA. A dog with this autosomal recessive genodermatosis is born with a normal coat but as the dog matures, usually beginning at between 4 months of age and 3 years of age, it will develop varying degrees of hypotrichosis (including frank alopecia) affecting the "dilute color" areas only. The hair coat will become dull and there will be scaling and comedone formation. Secondary bacterial pyodermas are frequently present. The exact cause of the hair shaft abnormality is not known but is believed to be related to a dysfunctional melanin transfer from the melanosomes to the hair matrix or a defect in the storage of the melanin once it is in the hair shaft. The result is melanin clumping. This clumping leads to weakening and eventual fracturing of the hair shaft. Diagnosis is based on hx, PE, the appearance of hairs on a trichogram, r/o other alopecic diseases (especially Demodex, dermatophytosis, bacterial pyoderma, and endocrinopathies) and is supported by histopathology. Microscopic examination of plucked hairs will reveal melanin clumping in the hair shafts and disruption of the normal hair shaft architecture. Treatment (other than elimination from the breeding stock) is directed toward managing the secondary pyodermas and seborrhea. Bathing, humectants, fatty acids +/- antibiotics are the mainstay of therapy. Melatonin, which can stimulate hair cycling, has also been reported to improve hair coats in some dogs. The author uses melatonin, 6 mg tid, as a 90-day therapeutic trial.

BHFD is an alopecic disease of dogs with bicolored or tricolored hair coats such as Boston Terriers, Basset hounds, and Cocker spaniels. It has been reported to be inherited as an autosomal recessive trait. This tardive disease is also believed to be due to a defective transfer of melanin leading to melanin clumping that weakens the hairs and eventual fracture. Usually, abnormalities of the hair coat are noted by the time the dogs are weaned. Initially changes consist of a dull hair coat affecting only black hairs. Eventually, these areas become alopecic. As with CDA secondary pyodermas may occur. It may be easiest to think of BHFD as a localized form of CDA. Histopathology is

similar to CDA, and diagnosis is based on signalment, hx, PE, the appearance of hairs on a trichogram and can be supported by histopathology. Treatment is the same as CDA.

Non-colored link follicular dysplasias have been reported in several breeds including Portuguese Waterdogs, Irish Water Spaniels, and Curly Coated Retrievers. Between 6 months and 6 yrs of age (depending on the breed), these dogs develop symmetrical hypotrichosis to alopecia usually beginning on the neck and progressing to the shoulders, trunk, tail, and thighs. Any remaining truncal hairs may have a color change (lightening). In dogs, estrogen receptors are present in telogen hair follicles and are important in keeping hairs in this phase. In Irish Water Spaniels dietary change (avoiding soy which may contain phytoestrogens) has been reported to be effective. Melatonin and trilostane both block estrogen receptors and may account for the effectiveness of these drugs in a variety of canine alopecic diseases.

Pattern baldness alopecia (PBA) is also a tardive genodermatosis.[xii] The dogs are born with a normal coat but develop PBA at 6 months-1 year of age. There are 4 different forms of this non-inflammatory, non-pruritic alopecia. One form occurs in male Dachshunds. These dogs develop a slowly progressive alopecia and hyperpigmentation of the pinnae. A second form occurs primarily in female Dachshunds, Chihuahuas, Whippets, Manchester Terriers, Greyhounds, and Italian Greyhounds. This form is identical to the first form except for the distribution of the alopecia. In this form, there is progressive alopecia caudal to and involving the pinnae, ventral neck, ventrum, and caudomedial thighs. The 3rd form affects American Water Spaniels and Portuguese Water Dogs (see above). The last form is seen affecting the caudolateral thighs of Greyhounds. Regardless of the form of the PBA, diagnosis is made on signalment, hx, PE, ruling out other alopecic diseases and supported by histopathology in which there is miniaturization of hair follicles and shafts with normal adnexa. There have been reports of some dogs improving with melatonin.

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Inflammatory Alopecia in the Dog and Cat

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Introduction

In general, inflammatory alopecia is relatively common in the dog and cat. Considering hair loss due to pruritic trauma, it is perhaps one of the more typical observations in a small animal companion practice. Traumatic hair loss secondary to purely hypersensitivity/allergic causes will not be covered here, as they are discussed extensively in other lectures. The conditions covered here are a selected, and not exhaustive list, of inflammatory alopecias in the dog and cat.

Common causes for inflammatory alopecia include bacterial folliculitis secondary to *Staphylococcus* infection, dermatophytosis, and demodicosis. Less common-to-rare infectious causes of inflammatory hair loss include *Pseudomonas* folliculitis/furunculosis and *Pelodera* dermatitis. There are also believed immune-mediated targets on hair follicles such as pseudopelade and alopecia areata that can appear non-inflammatory to the clinician, but are, indeed, inflammatory when viewed on skin biopsy. Finally, there are hair loss disorders due to underlying neoplasia, most commonly affecting cats, that can present with outward signs of inflammation and skin lesions.

Hair Follicle Anatomy

Domestic dogs and cats have compound hair follicles, consisting of a single primary hair as well as multiple secondary hairs, all existing through the same follicular os. A single examined hair can be described in three distinct sections – the **infundibulum** or upper portion from the skin's surface to the entrance of the sebaceous gland's duct; the **isthmus**, or middle portion, from the entrance of the sebaceous duct to the attachment of the arrector pili muscle; and the **inferior** portion, which is from the attachment of the arrector pili muscle to the dermal hair papilla. The hair shaft itself is divided into medulla, cortex, and cuticle – the medulla being the innermost portion, the cortex the middle portion, and the cuticle the outer section.

Patient History

When working up a case of a companion animal with alopecia, a detailed clinical history is invaluable. Some important questions to ask are as follows:

1) At what age did the animal begin losing hair?
2) Is the animal pruritic? (licking, chewing, rubbing, biting, scratching)
    a. If so, at what age did this start? Is it seasonal? Is the animal on ectoparasite and endoparasite preventatives? Which ones?
3) Where did the hair loss begin on the patient's body?
4) Has the hair loss been progressive?
5) Does the severity of the hair loss change with the time of the year?

Patient Exam

A detailed patient exam is essential, both a general physical and careful dermatologic exam. In the general physical exam, the clinician should assess all major systems.

GENERAL APPEARANCE:
INTEGUMENTARY:
EYES/EARS/NOSE/THROAT:
MUSCULOSKELETAL:
CARDIOVASCULAR:
RESPIRATORY:
DIGESTIVE:
GENITOURINARY:
NERVOUS SYSTEM:
LYMPH NODES:
ENDOCRINE:

Skin Lesions

A thorough dermatologic exam should be performed that focuses on the skin, ears, mucous membranes, and hair coat and identifies any lesions and abnormalities. Some common lesions of the skin include:

Papule: elevated lesion, solid, less than 0.5cm that projects above the surrounding skin

Pustule: raised cavity over the skin or hair follicle that contains pus

Furuncle: follicle-centered nodule, usually greater than 1cm; think ruptured hair follicle and surrounding inflammation

Comedo: a dilated hair follicle in which the infundibulum is plugged with keratin debris; the black color is the oxidized sebaceous material within the debris

Erythema: pink-to-red color of the skin due to dilation in blood vessels

Scale: flake coming from the stratum corneum skin layer

Crust: hardened exudate, serum, blood, or other substance on the skin's surface

Common Dermatologic Diagnostic Tests

Direct Impression Cytology: Direct smears performed for fluid-filled lesions: a small amount of material is collected and smeared on a microscope slide. Impression smears for moist or greasy lesions: the microscope slide is pressed directly against the site of interest. (crust must be removed prior). Slides are stained (typically with DiffQuik®) and then examined.

Tape Impression Cytology: Repeatedly press clear acetate tape to the area of interest. Adhere one edge tape to the end of a microscope slide and allow the remainder to "hang" off of the rest of the slide and stain with DiffQuik® (omitting the first alcohol solution step). Then press the rest of the tape to the slide and examine under the microscope.

Superficial Skin Scraping: Multiple, broad surface areas are scraped using a scalpel blade or spatula at an angle to collect a large amount of surface material on a glass slide. Mineral oil is used to help material adhere to slide and a coverslip is placed prior to examination.

Deep Skin Scraping: Skin is squeezed between the thumb and forefinger. Mineral oil is applied to the skin or scalpel/spatula and the area is scraped using moderate pressure in the direction of the growth of the hair. Material collected is placed on a glass slide and the process is repeated until capillary bleeding is achieved. Mineral oil is used to help material adhere to slide and a coverslip is placed prior to examination.

Trichrography/Trichrogram: Remove a small amount of hair from the animal gently with fingers and not an instrument that will introduce pinch or crush artifact. Secure the hairs to a microscope slide with mineral oil and place a cover slip on top before examining the hairs.

- Examine hair tips for signs of breakage (may be supportive of the animal rubbing or scratching).
- Examine the hair shafts for signs of pigmentary clumping (dilute color breeds), ectoparasite eggs (*Cheyletiella*, lice), ectothrix (dermatophytes).
- Examine the hair roots to determine the stage of the hair and count the number of hairs in anagen, catagen, and telogen to make an assessment if the follicles appear to be cycling normally.

Bacterial Skin Culture: When able, a fresh pustule can be ruptured using a sterile needle and its contents collected for culture. Superficial crusts can be gently elevated using the side of a microscope slide and a culture swab can be rubbed underneath to obtain a culture. For deeper lesions, the surface can be gently cleaned using sterile saline and dried using sterile gauze and then the skin can be squeezed so that material from the deeper skin is obtained for culture. Alternatively, a skin biopsy can be submitted from deeper lesions for culture.

Dermatophyte Test Medium (DTM): Clean the area of interest gently with alcohol and allow to dry before collecting hair and crust from the lesioned skin. Gently press these samples to the DTM with sterile forceps using care not to penetrate the medium. Examine the medium daily for 2-3 weeks and record findings. The sample should be kept at room temperature. When no lesions are present, the toothbrush method can be used to collect hairs from a larger area of the animal.

Dermatophyte PCR: Hairs and crusts are collected as described above but submitted to a lab as directed on their submission form.

Skin Biopsy: Gentle remove hair with scissors if needed in long-haired animals, but do not shave with clippers. Also, do not prep the skin in advance of skin biopsies as this could remove the crust, scale, etc., which may be needed for the diagnosis. Collect at least three 6mm punch biopsies through affected, lesioned skin to submit for examination. Exceptions: for ulcerated lesions, collect elliptical samples extended from normal INTO the ulcerated skin so that the pathologist may evaluated what happens at the transition area from ulcer to non-ulcer. For alopecic-only conditions, collect biopsies from both areas of affected and unaffected skin. Label everything appropriately. For detailed instructions: https://www.vet.cornell.edu/animal-health-diagnostic-center/testing/testing-protocols-interpretations/dermatopathology.

Infectious Causes of Folliculitis

Bacterial:
Staphylococcus
Typical signalment – dogs and cats of any age if they have an underlying condition that predisposes them
Clinical signs/ skin lesions – papules, pustules, crusts, alopecia, epidermal collarettes, furuncles
Diagnosis – skin impression cytology; bacterial culture

Pseudomonas
Typical signalment – dogs, classic case is post-grooming furunculosis
Clinical signs/ skin lesions – papules, crusts, pustules (rarely), furuncles, alopecia
Diagnosis – skin impression cytology; bacterial culture

Fungal:
Dermatophytosis
Typical signalment – dogs and cats of any age, immunocompromised patients more at risk
Clinical signs/ skin lesions – often focal or multifocal areas of annular hair loss with or without scale or erythema; could see crust, papules, miliary dermatitis; rarely pruritic
Diagnosis – DTM; fungal PCR

Parasitic:
Demodicosis
Typical signalment with *D. canis* – juvenile-onset: young dogs less than 18 months old; adult-onset: older dogs may have some underlying disease or be taking immunosuppressant medications; cats usually have some immunosuppression with *D. cati*, the follicular Demodex mite, though pruritic, otitis externa has also been observed and reported.
Clinical signs/ skin lesions – focal or multifocal areas of alopecia, with or without comedones, papules, pustules; lesions may be more widespread in adult-onset form and generalized juvenile version; folliculitis can lead to furunculosis; secondary bacterial infections common
Diagnosis – deep skin scraping

Pelodera
Typical signalment –dogs kept in unclean living conditions where nematode is present
Clinical signs/ skin lesions – erythema, alopecia, eventual papules and crusts; often affects feet, legs, whatever area of the body met the larvae of *Pelodera strongyloides*
Diagnosis – skin biopsy (can see nematode segments in hair follicles)

Immune-Mediated Causes of Hair Loss

Alopecia Areata:
Typical signalment – unclear, limited studies available to review
Clinical signs/ skin lesions – focal or multifocal patches of alopecia; clinically non-inflammatory
Diagnosis – skin biopsy (histologically, inflammation at anagen hair bulb)

Pseudopelade:
Typical signalment – unclear, limited studies available in dogs to review
Clinical signs/ skin lesions – focal, well-circumscribed areas of alopecia, clinically non-inflammatory; could be more diffuse alopecia with or without scale and hyperpigmentation
Diagnosis – skin biopsy (histologically, inflammation follicle isthmus)

Paraneoplastic Causes of Hair Loss

Paraneoplastic Alopecia:
Typical signalment – cat, over 10 years of age
Clinical signs/ skin lesions – progressive alopecia over weeks to months spreading over most of body, especially affecting ventrum and limbs; focal erythema; "shiny" skin; often see scale
Diagnosis – skin biopsy; look for internal neoplasia

Exfoliative Dermatitis with and without Thymoma:
Typical signalment – cat, middle aged-to-older

Clinical signs/ skin lesions – marked, generalized flaking and scaling; erythema can be present and can be focal or generalized; patches of alopecia; thickened skin; crusting; often starts on heads and then spreads
Diagnosis – skin biopsy; look for internal tumor

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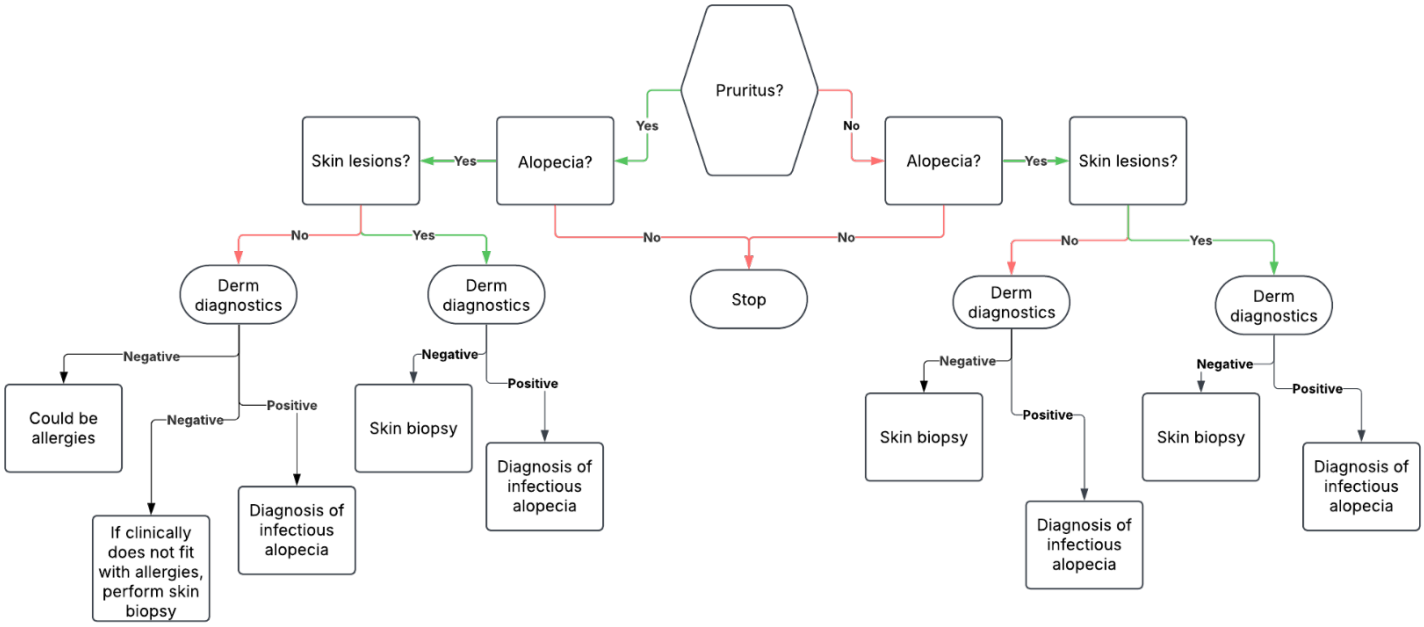
Diagnostic Flow Chart



MONDAY, APRIL 28, 2025 | 2:00 PM

Hairy Hurdles part 1 – Follicular Anatomy and Tumors

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Anatomy of the hair follicle:

The normal anagen hair follicle (HF) consists of three major structures (outer root sheath (ORS), inner root sheath (IRS), and hair shaft), subdivided into 8 concentric layers.

The ORS varies in thickness and is composed of cells with clear/glycogenated cytoplasm that becomes more eosinophilic as the cells mature towards the epidermal surface. This portion of the ORS is the *trichilemma*. The ORS arises from bulge stem cells.

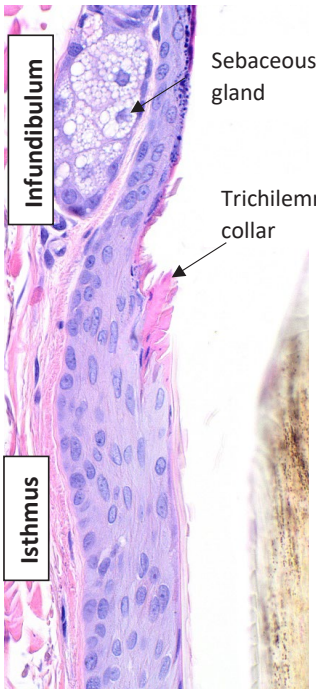
The IRS, from the outside to the inside, consists of the *Henle layer*, *Huxley layer*, and the *IRS cuticle*. The *companion layer* is a thin, barely visible layer between the ORS and the IRS. The IRS, hair shaft and companion layer arise from the matrix cells that populate the bulb.

The hair shaft, from the outside to the inside, consists of the *hair cuticle*, the *cortex*, and the *medulla*. The cells of the hair shaft are called trichocytes, which are still nucleated and contain trichohyalin granules in the suprabulbar area of the inferior portion.

The anagen (growing) HF can be divided into three major anatomic regions.

1. The **infundibulum** extends from the opening of the hair follicle to the opening of the sebaceous gland duct. The outer root sheath of the HF joins the epidermis and cannot be differentiated from the epidermis histologically. Blue keratohyalin granules are present in the stratum granulosum of the epidermis and in the infundibulum of the HF. At the junction of infundibulum and isthmus, there is a small area of trichilemmal keratinization (trichilemmal collar; Figure 1).
2. The **isthmus** extends from the entrance of the sebaceous duct to the attachment of the arrector pili muscle and contains the bulge that is the main stem cell bearing region of the HF. No granules are present in the isthmic region of the HF. The Adamson fringe depicts the junction of the isthmus to the inferior portion and is characterized by full cornification of the inner root sheath and trichocytes of the hair shaft medulla (Figure 2).
3. The **inferior portion** extends from the Adamson fringe to the base of the follicle and contains the suprabulbar and a bulbar region. Within a concavity of the bulb surrounded by matrix cells is the dermal papilla, the only mesenchymal

component of the HF. The suprabulbar region shows red trichohyalin granules within the non-cornified Huxley's and Henley's layer of the IRS as well as within the hair shaft medulla (Figure 2).



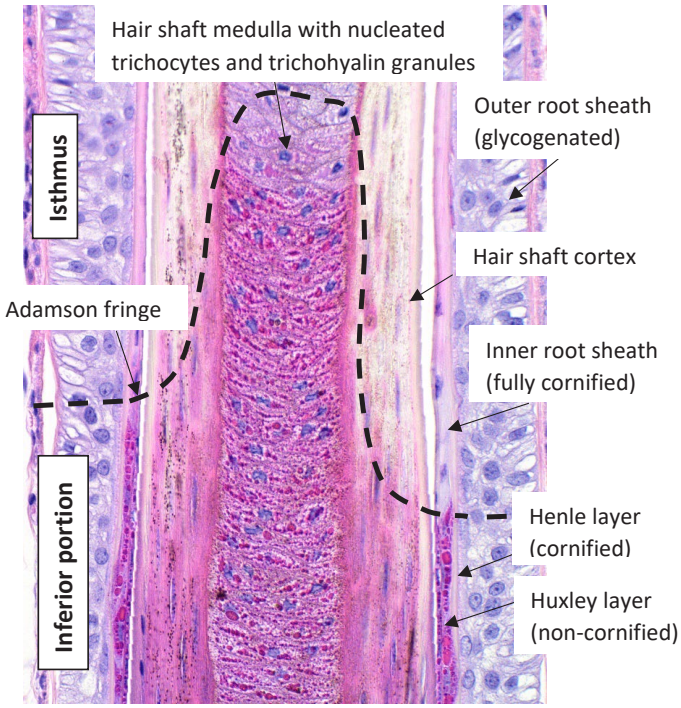


Figure 1. Junction of the infundibulum and isthmus. The junction is marked by a small area of trichilemmal keratin (trichilemmal collar). Note that there are blue keratohyalin granules in the infundibulum and no granules in the isthmus.

Figure 2. Junction of the isthmus and inferior portion. In the inferior portion, there are red trichohyalin granules in the non-cornified layers of the inner root sheath. The Henle layer cornifies first, the Huxley layer later. The Adamson fringe (dashed line) marks the transition from inferior portion to isthmus where all the layers of the inner root sheath and the trichocytes of the hair shaft are fully cornified.

SUMMARY OF HAIR FOLLICLE ANATOMY

- The ORS has glycogenated cells in the inferior portion and lower isthmus, but not in the upper isthmus
- The IRS consists of three layers: The cuticle, Huxley and Henle layer. The Henle layer cornifies first, the Huxley layer later at the Adamson fringe
- Between the ORS and the IRS is the thin, barely visible companion layer
- The hair shaft consists of three layers: The medulla, cortex and cuticle
- Trichocytes are the cells of the hair shaft, which are nucleated with trichohyalin granules in the hair shaft medulla of the inferior portion
- Keratohyalin granules (blue) are in the infundibulum and in the epidermis
- Trichohyalin granules (red) are in the inferior portion (non-cornified IRS, hair shaft medulla)
- There are no granules in the isthmus
- Junction of infundibulum to isthmus: Trichilemmal collar
- Junction of isthmus to inferior portion: Adamson fringe (fully cornified IRS and trichocytes)

FOLLICULAR TUMORS (KEY FEATURES FOR DIAGNOSIS)

NEOPLASTIC

Usually, the follicular tumors are solitary, but multiple tumors may occur (e.g., infundibular keratinizing acanthoma and trichoepithelioma). Follicular neoplasms are usually benign and complete excision is curative. However, pilomatricomas and trichoblastomas can be malignant. The histologic features are similar to the benign forms, but the tumors are invasive with desmoplasia and can metastasize to regional lymph nodes, bone, lungs and rarely other organs. Trichoblastic carcinomas (malignant trichoblastomas) exist in humans and potentially in dogs (personal observation).

Infundibulum

Infundibular keratinizing acanthoma

- Pore opening to the surface
- Central primary cyst with radiating keratinous cysts
- Anastomosing trabeculae supported by mucinous matrix
- Stratified squamous epithelium with keratohyalin granules
- May have chondroid metaplasia
- Frequently are ruptured with associated inflammation due to squeezing of the lesion by the owners

Isthmus

Trichoblastoma

Derived from follicular germinative cells in the outer root sheath of the HF.

Five subtypes: Ribbon/medusoid, trabecular, spindle, granular, solid-cystic

Ribbon/medusoid:

- Long cords of branching, radiating and anastomosing cords consisting of basaloid cells
- Often palisading appearance
- Can have a large amount stroma between cords
- Medusoid: Similar appearance than ribbon type but cells radiate from a central aggregation of cells (“medusa head”)
- No contiguity with epidermis
- Main type of trichoblastomas in dogs

Trabecular:

- Lobules of neoplastic cells arranged in broad cords and islands
- Palisading cells at periphery of each cord or nest
- No contiguity with epidermis
- Main type of trichoblastomas in cats

Solid/cystic:

- Solid islands of cells with variably sized cystic areas (cystic degeneration)
- May have many accumulations of melanin
- Cells may have clear cytoplasm (glycogenated cells)

- Usually no contiguity with epidermis
- Dogs have usually a predominantly solid and cats a predominantly cystic pattern

Granular:

- Resemble ribbon type trichblastomas but in some areas the neoplastic cells have abundant, eosinophilic, granular cytoplasm

Spindle:

- Areas consisting of fusiform cells with an interwoven pattern
- May have melanin aggregates
- May have epidermal contiguity (kidney or bean-shaped with central indentation)

Tricholemmoma, isthmic type

- Rare type of follicular tumor
- Small, eosinophilic cords and trabeculae that radiate from large epithelial nests and islands
- No granules
- May have melanin aggregates
- Rare epidermal contiguity

Inferior portion

Tricholemmoma, bulb type (inferior type)

- Rare type of follicular tumor
- Nests and trabeculae with a pale (clear) cytoplasm in the outer layer and more deeply eosinophilic towards the center
- Peripheral palisading
- No epidermal contiguity

Pilomatricoma

- Variably-sized cysts lined by matrix cells (small, basophilic cells)
- Trichohyalin granules
- Ghost cells
- Abrupt keratinization
- Mineralization or osseous metaplasia is common
- Frequently ruptures (the only remnants of the tumor can be ghost cells surrounded by pyogranulomatous inflammation)
- The malignant form has similar features but is invasive with desmoplasia and increased nuclear atypia

All portions

Trichoepithelioma

- Variably-sized cysts lined by matrix cells (small, basophilic cells) and stratified squamous epithelium
- Kerato- and trichohyalin granules

- Ghost cells
- Gradual and abrupt keratinization
- Mineralization or osseous metaplasia may occur
- Frequently ruptures (the only remnants of the tumor can be ghost cells surrounded by pyogranulomatous inflammation)
- The malignant form has similar features but is invasive with desmoplasia and increased nuclear atypia. Malignant trichoepitheliomas have increased matrix cells making the differentiation between malignant trichoepitheliomas and malignant pilomatricomas difficult.

Trichofolliculoma

This may be a non-neoplastic, hamartoma-like lesion rather than a true neoplasm

- Hair follicles radiating from a cystic centers
- Various stages of maturation, including sebaceous glands
- May have ghost cells
- Common in guinea pigs

NON-NEOPLASTIC (CYSTS AND HAMARTOMAS)

CYSTS

Infundibulum

Infundibular cyst

Infundibular cysts

- Lined by stratified squamous epithelium
- Keratohyalin granules
- Gradual keratinization

Isthmus

Isthmus cyst

- No granules
- May have glycogenated epithelium, resembling the outer root sheath of the HF
- A specific subtype is the flame follicle cyst
    - Siberian huskies
    - Excessive trichilemmal keratinization
    - Wrinkled cyst lining

Inferior portion

Matrical cyst

- Lined by matrix cells
- Trichohyalin granules
- Ghost cells
- Abrupt keratinization

Several portions

Panepidermal/hybrid cyst

Panepidermal cysts have features of all three HF portions; hybrid cysts have features of two of the HF portions

- Lined by stratified squamous epithelium and matrix cells
- Kerato- and trichohyalin granules
- Ghost cells
- Gradual and abrupt keratinization

HAMARTOMAS

Follicular hamartoma

- Large anagen hair follicles extending deep into the subcutis
- No distortion or dysplasia of hair follicles
- The hair follicle compounds are surrounded by dense collagen
- May be associated with severely dilated apocrine glands
- Number and extent of lesion may increase over time and may involve an entire leg

Fibroadnexal hamartoma

- Mass consisting of large, distorted hair follicles with sebaceous glands and apocrine glands
- Distinct mass in the dermis and subcutis
- Large amount of connective tissue
- No hair bulbs are present
- Often in areas of pressure points or previous trauma/surgery

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MONDAY, APRIL 28, 2025 | 3:00 PM

Hairy Hurdles part 2 – Hair cycle and Non-inflammatory Alopecia

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The hair follicle (HF) is a complex mini organ that self-renews during the hair cycle throughout the entire life of an individual. The hair cycle is influenced by factors derived from the follicular microenvironment, the dermal macroenvironment, systemic and environmental factors and also nutrition, age, genetic background and seasonal changes.

Hair cycle phases of the hair follicle:

ANAGEN (GROWING PHASE)

The infundibulum and the isthmus constitute the permanent portion of the anagen HF, whereas the inferior segment is transitory and undergoes regression during catagen und is absent during telogen.

The bulb of the hair follicle is within the subcutis. In catagen, the inferior portion regresses, which results in moving of the hair follicle up in the dermis.

CATAGEN (REGRESSING PHASE)

In catagen, the inferior portion of the anagen hair follicle regresses with a connective tissue trail following the dermal papilla (Figure 1). Between the hair shaft and the dermal papilla there is an epithelial strand, which shows increased numbers of apoptotic cells and the mitotic rate ceases, resulting in regression of the HF. The IRS is gradually replaced by trichilemmal keratin, and the club hair is formed.

TELOGEN (RESTING PHASE)

Telogen HF do not have an inferior portion or an IRS. The whole hair follicle is located within the dermis. The club hair is surrounded by trichilemmal keratin, anchoring the hair shaft to the HF wall. The dermal papilla is located outside at the base of the HF (Figure 1).

KENOGEN

Kenogen (hairless telogen) is a telogen hair that already underwent exogen and a hair shaft is absent. It is normal to have some kenogen HFs during the hair cycle (~20% in breeds with an asynchronous hair cycle and in anagen-dominant breeds only a small percentage); however, if anagen induction is insufficient, there is an increase in kenogen and hair cycle arrest. Prolonged kenogen phases may lead to follicular atrophy.

EXOGEN

Exogen is the active expulsion of the hair shaft and can happen anytime during the hair cycle.

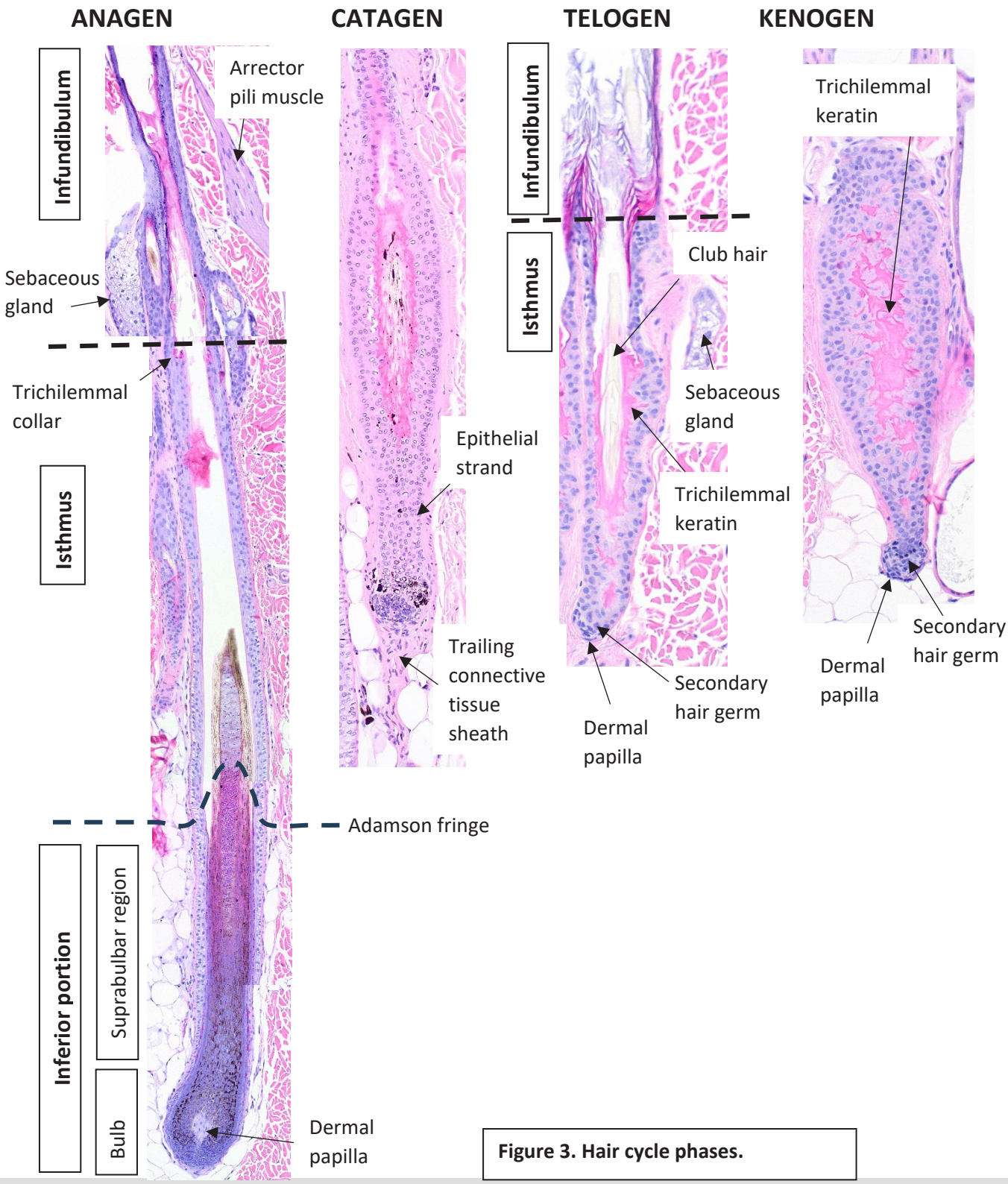


Figure 3. Hair cycle phases.

KEYPOINTS TO RECOGNIZE HAIR CYLE PHASES

Anagen:

- The inner root sheath (IRS) is present (partially or non-cornified in the inferior portion, fully cornified in the isthmus)
- Inferior portion with trichohyalin granules in the non-cornified layers of the IRS
- Bulb within subcutis
- Dermal papilla enclosed within bulb

Catagen:

- Epithelial strand between hair shaft and dermal papilla
- Trailing connective tissue sheath
- Apoptotic cells

Telogen:

- No inner root sheath
- Trichilemmal keratin anchoring the club hair
- Dermal papilla outside of hair follicle

Kenogen:

- No inner root sheath
- Trichilemmal keratin without hair shaft (hairless telogen)
- Dermal papilla outside of hair follicle

NON-INFLAMMATORY ALOPECIA

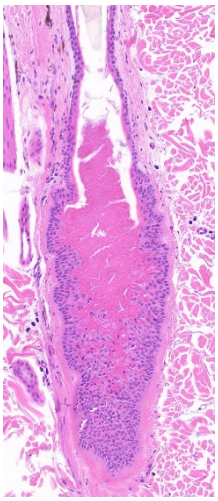
Decreased or impaired formation of cytodifferentiation
→ congenital alopecia (inherited or due to an *in utero* infection)
e.g.

- **Chinese crested dogs: Decreased or impaired hair follicle formation**
  - **Form of ectodermal dysplasia in true and semi-coated Chinese crested dogs**
  - ***FOXI3* mutation**
  - **Abnormal dentition, but no abnormalities in glandular tissue**
  - **Powderpuffs do not show any abnormalities in hair coat and dentition**
  - **Histology:**
    - **Dysplastic hair follicles with no isthmus or inferior portion**
    - **Comedone formation**
    - **Immature dermal papilla at the base of the follicular remnant**
- **Bald thigh syndrome: Impaired cytodifferentiation leads to decreased hair shaft quality**
  - **Sighthounds are affected**
  - **Structural defects in hair shafts cause hair breakage and therefore alopecia**
  - **Bilateral alopecia on the lateral thighs, ventral abdomen and ventral chest**
  - **Downregulation of genes that are important for proper hair shaft assembly (*keratin 71, desmoglein 1, desmocollin 2*)**
  - **Histology**

        - No clear differences between alopecic and haired skin
    - Scanning electron microscopy
        - Trichoschisis (transverse fracture of hair shaft)
        - Central trichoptilosis (central longitudinal splitting of hair shaft)
        - Longitudinal grooves and irregular contour of the hair shaft

Impaired postnatal regeneration
→ postnatal onset of alopecia (but starts early in life)
e.g.

- Alopecia X
    - Pomeranians
    - Young animals (<2 years)
    - Male predisposition
    - Bilateral symmetrical alopecia sparing head and front limbs
    - Possibly caused by alteration in the steroid hormone metabolism
    - Histology:
        - Hair cycle arrest
        - Increased kenogen and telogen hair follicles
        - Flame follicles (see picture)
        - May have epidermal and dermal atrophy


Flame follicle

- Hair follicle dysplasia
    - Cyclical flank alopecia/seasonal flank alopecia
        - Boxer, English and French bulldogs, Airedales, schnauzers, Rhodesian ridgeback
        - Recurrent episodes of sharply demarcated alopecic areas bilaterally in the flank region
        - About 50% of cases respond to melatonin
        - Atypical disease affecting the face only in Cane Corso and Dogues de Bordeaux
        - Histology:
            - Follicular dysplasia with irregular, “pear-shaped” contour, keratin extending into the openings of hair follicle in the follicular compounds, and atrophy of secondary hair follicles at the base (Witch’s feet)
            - May be associated with interface dermatitis in boxers
    - Color dilution alopecia/black hair follicle alopecia
        - Color dilution alopecia in dogs with dilute color (fawn, grey, blue, red)
        - Black hair follicle dysplasia in bi-or tricolored breed affecting only the black coat

        - Autosomal recessive mutation in the *melanophilin* gene associated with color diluted coat (but not all color diluted dogs develop alopecia)
        - Histology:
            - Hair follicle dysplasia with irregular contour and keratin extending into the openings of hair follicles in the follicular compounds
            - Melanin aggregates/clumping in hair follicle walls, hair shafts and perifollicular areas (mainly hair bulbs)
            - In color diluted dogs (with or without alopecia), melanin clumping in the epidermis

Impaired hair cycle
→ Late-onset alopecia (usually acquired)
e.g.

- Endocrinopathies (hyperadrenocorticism, hypothyroidism, hyperestrogenism)
    - Bilateral symmetrical alopecia (except estradiol cream-induced hyperestrogenism)
    - All endocrinopathies show similar histologic changes with a few potential differences (see box)
    - Histology:
        - Hair cycle arrest (no or only a few anagens)
        - Increased numbers of kenogen hair follicles
        - Increased numbers of telogen in hyperestrogenism and alopecia X
        - Hair follicle atrophy
        - Dilated hair follicle infundibula
        - Epidermal and dermal atrophy are inconsistent features
        - Hyperadrenocorticism may be associated with calcinosis cutis
        - All chronic endocrinopathies may have some hair follicle dysplasia (but this should not be the main feature)
- Postclipping alopecia
    - Lack of hair regrowth after clipping
    - Dogs with a long telogen phase are predisposed (e.g., Siberian huskies)
    - Cause is unknown
        - May take longer to regrow because clipped in early telogen and regrowth occurs only after the long telogen phase is finished
        - Vascular perfusion changes in response to temperature changes after clipping
        - Underlying preclinical endocrinopathies
    - Histology:
        - All hair follicles are in telogen

HINTS TO DIFFERENTIATE BETWEEN DISEASES WITH HAIR CYCLE ARREST HISTOLOGICALLY (the most valuable criteria are in Bold)

Hyperadrenocorticism:

- **Comedones**
- Atrophic epidermis (not a consistent feature)
- Atrophic sebaceous glands (not a consistent feature)
- Severe atrophy of hair follicles

Hypothyroidism:

- May have hyperplastic epidermis
- **Dermal inflammation (secondary pyoderma)**
- **Anagen hair follicles may still be present**
- Mucin deposition (rare)

Hyperestrogenism:

- May have hyperplastic epidermis
- Increased kenogen and **telogen hair follicles**

Alopecia X

- **Flame follicles**
- Increased kenogen and **telogen hair follicles**
- Thinner dermis (not a consistent feature)
- Epidermal atrophy (not a consistent feature)

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MONDAY, APRIL 28, 2025 | 4:30 PM

From Farm to Pharma: The Production of Allergen Extracts

TRICIA SOWERS, PHD

Course Learning Objectives

This session provides an in-depth exploration of the processes involved in transforming allergen-derived source material into high-quality allergen extracts used in immunotherapy. Participants will learn how allergenic plant species are cultivated and collected, and the techniques used to accomplish this. The session will cover plant-specific harvesting methods, post-harvest processing to isolate allergenic proteins, and the rigorous quality control measures that ensure purity, potency, and regulatory compliance. Additionally, the session will examine the specialized processes used to create source material and extracts from other important allergen sources, such as cat dander, house dust mites, and molds. This session highlights how these extracts form the basis of effective immunotherapy treatments for pets with environmental allergies.

Learning Objectives:

1. Explain the process of transforming allergen-derived source materials into high-quality extracts.
2. Identify methods for cultivating and collecting allergenic plants.
3. Describe processes for creating extracts from non-plant allergens like cat dander, mites, and molds.
4. Outline post-harvest processes for cleaning, isolating, and stabilizing allergenic proteins.
5. Discuss quality control and regulatory measures ensuring extract safety and potency.

1. Introduction

Allergen extracts play a crucial role in identifying and treating allergic disease. Their production involves a complex journey, beginning with raw material collection from natural sources and culminating in highly purified extracts suitable for clinical use. This process ensures that extracts are pure, safe, and effective for immunotherapy and diagnostic applications. Manufacturing requires strict regulatory compliance, adherence to Good Manufacturing Practices (GMP), and robust quality control measures.

2. Source Material Collection

Allergens originate from diverse biological sources, including plants, animals, fungi, and insects. Each source requires specialized collection and processing techniques to maintain allergen integrity and potency.

2.1 Pollen Collection

- **Types of pollen**: Grass, tree, and weed pollens are the most common allergenic sources.
- **Collection methods**: Pollen is harvested from field cultivation sites, tree orchards, and wild plants. It is collected via specialized pollen traps, vacuum collectors, or by hand from flowers and catkins.
- **Post-harvest processing**: Pollen undergoes drying, sieving, and purification to remove non-pollen debris before extraction. Microscopic analyses are performed to both confirm species identification and ensure minimal contamination with unrelated pollen species, insect, mold and plant particulate. Some pollens require additional steps for manufacturing readiness to be achieved, including defatting. This process removes the outer lipid layer of the pollen grain, allowing for improved extractability of allergenic proteins.

2.2 Mites Collection

- **Common species**: House dust mites (*Dermatophagoides farinae* and *Dermatophagoides pteronyssinus*) and storage mites (e.g., Acarus siro, Lepidoglyphus destructor, Tyrophagus putrescentiae) are common allergenic species.
- **Growth conditions**: Mites are cultivated in controlled laboratory environments, where temperature, humidity, and food supply are optimized for mass reproduction. Timing of colony termination should be consistent to avoid protein expression differences.
- **Processing**: After 4-6 weeks of cultivation, mites are separated from food remnants and the body and fecal matter are collected using filtration and centrifugation techniques. The degree of separation and standardization of source material is dependent on the intended manufacturer product.

2.3 Animal Epidermals Collection

- **Source animals**: Cats, dogs, horses, rabbits, and rodents.
- **Types of materials**: Hair, dander, epithelial cells, and pelt are used as allergen sources. This varies by species.

- **Collection methods**: Materials are obtained from USDA-approved veterinary sources, ensuring disease-free samples.
- **Processing**: They are washed, dried, and defatted before extraction. Organic solvents or mechanical separation techniques are used to remove excess fats and impurities.

2.4 Mold Collection

- **Common species**: *Aspergillus fumigatus*, *Penicillium*, *Cladosporium*, and *Alternaria*.
- **Cultivation**: Fungi are grown in broth cultures under controlled laboratory conditions for several weeks.
- **Processing**: The mold mat (mycelium and spores) is used in extract production.

2.5 Insect and Venom Collection

- **Insect species**: Honeybees, wasps, hornets, and yellow jackets.
- **Collection methods**: Venom is extracted via two primary methods:
  - **Electrostimulation**: A mild electric shock induces bees to secrete venom onto a glass plate for collection.
  - **Venom sac dissection**: Insects are dissected to remove venom sacs, which are then processed to extract allergenic proteins.
- **Processing**: The collected material is subjected to free-drying to prevent rapid proteolytic degradation. It is then purified and evaluated for major allergen concentrations. The purified product is then lyophilized and ready for clinical use.

3. Extraction

Once collected and purified, processed source materials undergo controlled manufacturing steps to ensure purity and potency. This is relatively simple manufacturing process, but conditions need to be carefully monitored to ensure lot to lot consistency.

- **Buffer solutions**: Source materials are mixed with buffered solutions such as saline, bicarbonate, or phosphate buffers.
- **Incubation**: The material is allowed to incubate for up to 48 hours at controlled temperatures to maximize protein solubilization. In many instances, the source material is continuously mixed during this extraction period.
- **Filtration**: The extract is passed through fine mesh or micropore filters to remove solid particles and obtain a clear solution. Most extractions are filtered at least twice to increase purity.
- **Batch sizes**: Extraction may occur in 4-liter or larger batches, depending on the source and intended use.

4. Characterization and Standardization

To ensure quality, extracts undergo biochemical and immunological characterization. While extracts do vary from lot to lot, due to the nature of the source material utilized, manufacturers monitor extract parameters to minimize variances.

4.1 Protein Quantification

- **PNU (Protein Nitrogen Units)**: Measures the total protein content in an extract.
- **Major allergen analysis**: Key allergenic proteins are quantified using ELISA, mass spectrometry, and radial immunodiffusion assays.

4.2 Potency and Standardization

- **Standardized extracts**: Some allergens, such as grass pollen and house dust mite, are adjusted to specific potency levels (e.g., BAU/mL – Bioequivalent Allergy Units) for use in human allergy sufferers. This level of standardization, however, is not implemented for veterinary extracts.
- **Non-standardized extracts**: These are labeled based on weight-to-volume ratios (e.g., 1:10 w/v) or PNU concentration, but do not have defined, standardized potency.
- **FDA standards**: For standardized allergens, such as cat, mite, and select pollens, reference standards from the FDA guide formulation and potency labeling. These extracts are not commonly used in veterinary allergy applications due to the presence of 50% glycerin.

4.3 Safety and Sterility Testing

- **Microbial testing**: Ensures extracts are free from bacteria, fungi, and endotoxins. This is required for lot release of many manufactured extracts.
- **Stability studies**: Long-term stability assessments ensure that extracts retain potency over time under controlled storage conditions. A safety sample is required to be maintained for each lot of extract produced; these are maintained until lot expiration is achieved.
- **Batch consistency**: Specific allergen lots (e.g., mixed mites) are evaluated for consistency in major allergen concentrations, with set variation limits (±10–33%). Most major allergen testing, however, is limited to FDA-regulated extracts, not those used for Veterinary allergy.

5. Final Formulation and Packaging

Extracts are formulated into different solutions to suit clinical needs:

5.1 Solution Types

- **Aqueous solutions**: Saline-based with phenol preservatives; lower stability, with greater risk for precipitation. These extracts are used exclusively in veterinary allergy applications. Dating does not exceed 18 months.
- **Glycerinated solutions**: Contain 50% glycerin, offering extended shelf life and stability but may cause discomfort upon injection. Glycerinated extracts can be used for SLIT drop compounding. They afford a sweet quality to the SLIT drops.
- **Lyophilized extracts**: Freeze-dried powders, particularly for venom allergens, which require reconstitution before use. These are the most shelf stable extract products, but they are not widely available. Once reconstituted, the shelf life is similar to non-standardized, aqueous extracts.

5.2 Packaging and Labeling

- **Vial sizes**: Extracts are distributed in 10mL, 30mL, and 50mL vials, depending on intended use.
- **Potency labeling**: Vials are labeled with potency units such as BAU/mL, AU/mL, or PNU.
- **Storage conditions**: Most extracts require refrigeration to maintain stability, while lyophilized extracts can be stored at room temperature. Extract stability is impacted by dilution, so stability and expiration dating should be carefully considered.

6. Conclusion

The production of allergen extracts is a meticulous process requiring stringent quality control from raw material sourcing to final formulation. By ensuring purity, potency, and stability, well-characterized extracts provide effective immunotherapy treatments and aid in identifying the allergens to which an animal is sensitized. Adhering to regulatory standards and good manufacturing practices ensures that allergen extracts remain safe and reliable for clinical use.

MONDAY, APRIL 28, 2025 | 10:00 AM

31: An alternative staining technique for cytology

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Abstract: Modified Romanowsky stain (RS, DiffQuik®, Jorgensen Laboratories; Loveland, CO, USA), is used in veterinary clinics for in-house cytological microscopic analysis of slides. RS is applicable to stain fecal, blood, skin and ear samples. Samples are dipped directly into jars of stain, and the stain is used multiple times before it is changed. Studies have shown that bacteria can survive in RS solutions, raising concerns for potential misdiagnosis of infections and inappropriate antibiotics prescribed. This study evaluates the impact of a tray staining technique (Slide staining plate, AmScope™; Irvine, CA, USA) on the quantity of antibiotics prescribed at a veterinary dermatology clinic. The authors describe the tray staining method avoids contamination of RS stain with the sample. In a retrospective comparison study, electronic veterinary records were searched for antibiotic dispensing data for two years before and two years after implementation of this tray staining technique. Twelve antibiotics (topical or systemic), each dispensed more than 100 times prior to the tray staining technique, were included. To avoid comparison of pills to milliliters, percent change from pre to post tray staining technique for each antibiotic was analyzed. The number of appointments during the timeframe were obtained to determine whether appointments and prescription changes were confounded. The average annual antibiotic prescriptions decreased significantly (p=0.02) by 28.5% (SE=10.6%), while appointments declined by 12%. The tray staining technique should be strongly considered as an alternative to the dipping method. Measures taken to avoid bacterial contamination of stain solutions may lead to a reduction in antibiotic use.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 10:15 AM

33: Multidrug-resistant bacteria isolated from canine skin infections across receiving services at the University of Minnesota Veterinary Medical Center: a retrospective study

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Abstract: Identifying multidrug-resistant bacteria (MDRB) in veterinary hospitals is crucial for treatment guidance, public health risk mitigation and surveillance. This retrospective study aimed to determine the hospital MDRB prevalence, identify the most common MDRB isolated from canine skin infections and compare the MDRB and skin infections types among receiving services at the University of Minnesota Veterinary Medical Center between August 2021 and November 2024. Aerobic skin cultures submitted to the Clinical Pathology Laboratory were evaluated, where 438 cultures obtained from 416 dogs grew 647 bacteria. A total of 182 cultures from 178 dogs identified 196 MDRB. The hospital MDRB prevalence was 30% (196/647), MDR culture prevalence was 42% (182/438) and MDR patient prevalence was 43% (178/416). From 182 cultures, 163 (83%) were *Staphylococcus* spp., including 123 (63%) multidrug-resistant *Staphylococcus intermedius* group, where 73 (37%) were meticillin-resistant *S. intermedius* group (MRSIG), 10 (5.1%) *Staphylococcus schleiferi* and two (1%) meticillin-resistant *Staphylococcus aureus*. The skin infection types included pyodermas (90), superficial surgical site infections (SSSIs) (50), wounds (41), abscesses (eight) and masses (seven). Pyodermas were further classified into superficial (46), deep (30), surface (four) and nail or nail bed (four). MDRB were identified from dermatology (72), surgery (48), emergency/critical care (27), urgent care (18), primary care (14), neurology (eight), medicine (six) and oncology (three) services. The majority of MDRB were MRSIG with MDRB infections being more frequently associated with pyodermas, followed by SSIs and wounds. Dermatology and surgery services identified most of the MDRB. This study provides valuable data for targeted surveillance and interventions.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 10:30 AM

72: Effect of 72-hour transport delay of aerobic bacterial cultures to a reference laboratory on the *Staphylococcus* species isolated from canine pyoderma

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Abstract: The submission of bacterial cultures to a reference laboratory is standard practice in veterinary medicine. There is no known veterinary literature investigating the effects of a transport delay on culture results from canine pyoderma. The first objective was to evaluate the reliability of *Staphylococcus* species identification from aerobic bacterial cultures collected from canine pyoderma when transported to a reference laboratory on the collection day. The second objective was to evaluate the effect of a 72-hour transport delay on *Staphylococcus* spp. identification and antibiotic susceptibilities. Thirty client-owned dogs with pyoderma presented to a private dermatology clinic were included in this study. Three sterile culturettes were used to sequentially swab one pyoderma lesion per dog. Two samples were transported on the collection day (immediate cultures), while one was refrigerated for 72 h prior to transportation to a reference laboratory (delayed culture). Ninety cultures were performed and the results compared. There was good reliability of *Staphylococcus* spp. identification between the immediate cultures. There was no significant difference in the *Staphylococcus* spp. identification, *Staphylococcus* spp. methicillin resistance, or *Staphylococcus pseudintermedius* antibiotic susceptibilities with a 72-hour transport delay with the exception of chloramphenicol (8% of dogs). Cultures from canine pyoderma can have good reliability of *Staphylococcus* spp. identification when submitted to a reference laboratory on the collection day. Cultures that are delayed in 4°C for up to 72 h can still have reliable results regarding *S. pseudintermedius* identification and susceptibilities with the exception of chloramphenicol.

Sources of funding: Self-funded.

Conflicts of interest: None declared.

MONDAY, APRIL 28, 2025 | 10:45 AM

32: Duration of antibiotic therapy for canine superficial pyoderma: Is the one-week post resolution of clinical signs a valid rule-of-thumb?

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Abstract: This study aimed to determine if superficial pyoderma (SP) recurs sooner in dogs not treated one-week post-resolution, to assess the average time for SP resolution, and the correlation between infection severity and resistance patterns. Sixty-seven allergic dogs with cytologically confirmed SP were enrolled and randomly assigned to receive an oral antibiotic based on culture and susceptibility, for one-week past SP clinical resolution (group A) or until resolution (group B). Dogs were receiving consistent allergy treatment and topical antimicrobials were prohibited. Dogs were examined every 14 days until D98 unless excluded due to unresolved SP by D28 or SP recurrence before D98. At each visit, a dermatologic exam and pyoderma severity score (0-21) were performed. SP resolved in 20/37 (54%) dogs in group A and 18/30 (60%) in group B in 21.45 and 21.17 days (mean), respectively. SP recurred in 13/20 (65%) dogs in group A and 10/18 (55.5%) in group B in 45.31 and 29.3 days (mean), respectively. Clinical resolution of SP was not observed by D28 in 17/37 (46%) dogs in group A and 12/30 (40%) in group B. Failure was due to lack of antibiotic response (21; 72.4%), owner's compliance (4; 13.8%), adverse events (3; 10.3%), or yeast dermatitis (1; 3.4%). There was no statistically significant difference between the groups for time for SP resolution (p=0.92) or recurrence (p=0.94), and no statistically significant difference in clinical severity score across different resistance patterns (p=0.7). The results suggest that extended courses of systemic antibiotic are not necessary for canine SP treatment.

Source of funding: American Kennel Club Canine Health Foundation.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 11:30 AM

29: Curcumin decreases β-lactam resistance against canine meticillin-resistant *Staphylococcus pseudintermedius*; an in-vitro study

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Abstract: Meticillin-resistant *Staphylococcus pseudintermedius* (MRSP) has become increasingly widespread in veterinary medicine, with a reported prevalence of up to 40.5% in dogs with pyoderma. Previous studies have shown that curcumin derived from turmeric (*Curcuma longa L.*) exhibits a synergistic effect when combined with some β-lactam antibiotics, fluoroquinolones, tetracyclines, or vancomycin against American Type Culture Collection (ATCC) and clinical strains of meticillin-resistant *Staphylococcus aureus (MRSA).* Thus, the purpose of the study was to determine if curcumin (500 µg/mL), in combination with oxacillin, clavulanate-amoxicillin (Clavamox, Zoetis; Parsippany, NJ, USA), clindamycin, and doxycycline could decrease the minimum inhibitory concentration (MIC) of each antibiotic. A microbroth dilution method was used for this study. Twenty MRSP clinical isolates collected from dogs with pyoderma, one standardized ATCC meticillin-sensitive *Staphylococcus pseudintermedius*, and two standardized ATCC MRSA isolates were tested against antibiotics at their respective resistant, intermediate, and sensitive concentrations with or without curcumin. The presence or absence of a pellet at the concentrations tested for each antibiotic alone were compared to each antibiotic with curcumin using the Fisher's exact test. A $p<0.05$ was considered significant. A significant decrease in MICs was observed for oxacillin ($p=0.0004$) and clavulanate-amoxicillin ($p=0.047$), but not clindamycin or doxycycline. Wells without pellets were plated to determine minimum bacterial concentrations (MBCs) and all samples were found to have growth. These results suggest that curcumin may potentiate the efficacy of β-lactam antibiotics against MRSP, offering a promising novel approach to overcoming antibiotic resistance.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 11:45 AM

45: *In vitro* evaluation of the antimicrobial activity of retinaldehyde against clinical isolates of Staphylococcus pseudintermedius and Malassezia pachydermatis

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Abstract: The rise of antimicrobial resistance has posed challenges in treating dogs infected with meticillin-resistant *Staphylococcus pseudintermedius* (MRSP) and *Malassezia pachydermatis* (MP). This phenomenon highlights the need for novel therapies and improved antimicrobial stewardship. Retinoids are commonly used in both human and veterinary medicine for their anti-inflammatory and keratoregulatory properties. Furthermore, one derivative, retinaldehyde, has also been suggested to possess antimicrobial properties. This study aimed to evaluate the antimicrobial activity of retinaldehyde against clinical isolates of SP (n=30) and MP (n= 30) collected from dogs with skin or ear infections. Broth microdilution was used to determine the minimum inhibitory concentration (MIC) of retinaldehyde using eight two-fold dilutions (64 µg/mL - 0.5 µg/mL). After establishing the MIC, one dilution above the MIC was plated, and colonies were counted to determine the minimum bactericidal/fungicidal concentration (MBC/MFC) of retinaldehyde. The MIC/MBC/MFC_{50} and MIC/MBC/MFC_{90} were also calculated. The MIC and MBC/MFC were the same for most isolates with a median value of 8 µg/mL and 32 µg/mL for *SP* and *MP*, respectively. The MIC/MBC_{50} and MIC/MBC_{90} of retinaldehyde for *SP* were 8 µg/mL, whereas the MIC/MFC_{50} and MIC/MFC_{90} for MP were 32 µg/mL and 64 µg/mL, respectively. No statistically significant difference was found between meticillin-sensitive and meticillin-resistant SP ($p>0.999$). These findings suggest that retinaldehyde has antimicrobial properties against common organisms associated with microbial otitis and pyoderma *in vitro*. Further studies should explore the efficacy of retinaldehyde as a topical agent *in vivo*.

Source of funding: This is a self-funded study.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 12:00 PM

36: Alcohol is the cure: topical ethyl alcohol as a novel treatment for superficial bacterial pyoderma in dogs

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Abstract: Overuse of systemic antibiotics has led to a rise in multi-drug-resistant bacteria, highlighting the importance of topical antiseptics. In a prospective, randomized, blinded, split-body study, dermatological lesions were assigned topical treatment with chlorhexidine digluconate 3% (Douxo™ S3 Pyo mousse, CEVA; Libourne, France) or 70% ethyl alcohol (Purell™ Gel, GOJO Industries; Wooster, OH, USA) twice daily for 28 days. Fifteen client-owned dogs with bilaterally symmetrical lesions and cytology consistent with superficial pyoderma were enrolled. Patients were clinically scored based on coat condition, dermatologic lesions, and Pruritus Visual Analogue Score. Cytologic scoring was based on number of cocci and inflammatory cells at day (D) 0, 14, and 28 at 40x magnification. Clinical and cytologic scores were combined for a global score. Next-generation DNA sequencing (MiDOG LLC; Irvine, CA) characterized *Staphylococcus pseudintermedius* and *Staphylococcus schleiferi* loads at D0 and D28. Compared to D0, both treatments led to significant improvement in global scores (chlorhexidine 18.22 ± 3.54; ethyl alcohol 17.95 ± 3.78) at D14 (chlorhexidine 12.80 ± 2.74, $p \leq 0.0001$; ethyl alcohol 12.40 ± 3.06, $p \leq 0.0001$) and D28 (chlorhexidine 9.24 ± 3.57, $p \leq 0.0001$ and ethyl alcohol 8.40 ± 4.06, $p \leq 0.0001$) post-treatment. Both treatments led to a decrease in relative abundance of *S. pseudintermedius* (chlorhexidine -28.73% ± 42.86%; ethyl alcohol -25.66% ± 38.74%) and *S. schleiferi* (chlorhexidine -65.93% ± 13.03%; ethyl alcohol -79.82% ± 8.37%). Clinical scores were not significantly different between treatment groups at D28 ($p \leq 0.0001$). Data concluded that topical 70% ethyl alcohol was as efficacious as 3% chlorhexidine digluconate for treatment of superficial pyoderma.

Source of funding: Animal Skin and Allergy Clinic and Animal Dermatology Group.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 12:15 PM

47: Preliminary *in vitro* antimicrobial evaluation against *Staphylococcus pseudintermedius* and the lathering ability of currently available chlorhexidine-containing shampoos on the U.S. market

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Abstract: Chlorhexidine is an effective antimicrobial against *Staphylococcus pseudintermedius*. Shampoos range in chlorhexidine concentrations (2-4%) with formulation and bathing factors influencing antimicrobial efficacy. This preliminary study evaluates the effect of formulation and dilution on *in vitro* efficacy against a standard meticillin-sensitive *S. pseudintermedius* and one multi-drug meticillin-resistant *S. pseudintermedius* of eight chlorhexidine containing shampoos (Malaseb®, Miconahex+Triz®, TrizCHLOR® 4, BioHex™, Douxo® S3 PYO, KETOCHLOR®, ChlorhexiDerm™ 4%, Davis® Chlorhexidine). Control products included: one chloroxylenol shampoo (Universal Medicated), two non-chlorhexidine shampoos (DermaLyte®, Allergroom®) and a standardized 2% chlorhexidine solution. Lathering ability and lather stability were also evaluated. Minimum inhibitory concentration (MIC) was determined by broth microdilution. The first dilution with no visible growth and four preceding dilutions were plated on blood agar to determine the minimum bactericidal concentration (MBC). Lathering ability and lather stability was assessed using a modified cylinder shake method. MIC and MBC were compared for dilution ratio and chlorhexidine concentration with differences noted ($p<0.001$) using a Kruskal-Wallis test with Bonferroni correction. All products had a detectable MIC with negative control products having significantly higher MIC values ($p\leq0.006$). Miconahex+Triz®, Malaseb®, and TrizCHLOR® 4 had significantly lower MBCs ($p\leq0.017$) with DermaLyte® and Allergroom® having no detectable MBC. KETOCHLOR® and Davis® Chlorhexidine shampoos had significantly lower lathering ability ($p\leq0.041$). Over time all shampoos had a significant decrease in lather height. This preliminary study supports shampoo formulation affects chlorhexidine efficacy which needs further investigation with robust numbers of bacterial isolates and large scale head-to-head clinical trials to determine if *in vitro* variance has clinical significance.

Source of funding: The American College of Veterinary Dermatology resident's research award.

Conflict of interest: J. B. Pieper has received speaking honoraria from Virbac Animal Health, Vetoquinol and CEVA for continuing educations lectures. D. J. Berger is a current employee of Elanco Animal Health and has also received speaking honorarium from Virbac Animal Health in the last 5 years.

MONDAY, APRIL 28, 2025 | 2:00 PM

56: A preliminary study investigating a multidimensional pruritus scoring system, the 5-D itch scale, for assessment of pruritus in dogs with atopic dermatitis

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Abstract: The multidimensional human 5-D itch assessment tool measures the duration, degree, directionality, disability, and distribution of itch, which provides a better understanding of the impact of pruritus in skin diseases. The severity of pruritus in canine atopic dermatitis (AD) is commonly evaluated using the unidimensional pruritus Visual Analog Scale (pVAS); however, multidimensional evaluations of pruritus in dogs are limited. This study aimed to investigate the validity, reliability and responsiveness to change of a canine-adapted 5-D itch scale questionnaire in canine patients with AD. We found a strong correlation between the total 5-D itch and pVAS scores in 82 untreated dogs with AD (Spearman's r=0.86; 95% CI: 0.79-0.91). The Cronbach's α value for the five individual domains of the 5-D itch scale was 0.81, indicating good to excellent internal consistency. There was no change in median 5-D and pVAS scores between day 1 and day 3 in untreated AD dogs (intraclass correlation coefficient of 1.0 and 0.96, respectively). In 14 AD dogs, the 5D-itch and pVAS scores were obtained on days 1 and 28 after antipruritic intervention with lokivetmab. The median scores of 5-D itch and pVAS were significantly lower in dogs after antipruritic intervention (Wilcoxon signed-rank test, p<0.01 for both scores). Furthermore, the 5-D itch and pVAS scores during antipruritic intervention were strongly correlated (Spearman's r=0.86; 95% CI: 0.72-0.93). Our preliminary study demonstrates good validity, reliability and responsiveness of the canine-adapted 5-D itch scale questionnaire when assessing AD.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 2:15 PM

54: Evaluation of agreement between a novel veterinary molecular diagnostic serological allergen test (Pet Allergy Xplorer), conventional extract-based serological allergen test (Stallergenes Greer Laboratories, Idexx) and intradermal allergen test in 33 dogs with atopic dermatitis

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Abstract: The first veterinary recombinant serum allergy test (SAT), Pet Allergy Xplorer (PAX; Nextmune USA; Phoenix, AZ, USA), is now commercially available to help formulate allergen-specific immunotherapy for atopic dogs; however, no comparative evaluations of PAX to whole allergen-based SAT (WAS) platforms and intradermal allergen testing (IDAT) currently exist. We evaluated the correlation between IDAT, WAS (Stallergenes Greer Laboratories; Lenoir, NC, USA), and PAX for 25 allergens (four moulds, four mites, seven grasses, five weeds, four trees and flea allergen) in 33 atopic dogs. Additional allergens shared between platforms were included in the pairwise correlation between IDAT and PAX (32 total allergens), IDAT and WAS (38 allergens) and PAX and WAS (27 allergens). Fleiss and Cohen's kappa (k) were used to evaluate the correlation between allergy tests. Moderate agreement (k=0.45) was found between all tests for all 25 allergens; the correlations for grasses (k=0.53) and weeds (k=0.41) were moderate, whereas fair correlation was observed for trees (k=0.31) and mites (k=0.37). In the pairwise comparisons, WAS exhibited a moderate correlation to PAX (k=0.55) and IDAT (k=0.49) for all allergens, while IDAT and PAX had only fair agreement (k=0.28). Across all comparisons, substantial correlation was observed only for grasses between WAS and IDAT (k=0.63) and between WAS and PAX (k=0.67). Moderate correlation was shown for mites between WAS and IDAT (k=0.47) and between WAS and PAX (k=0.41). In conclusion, this study showed a moderate agreement between testing platforms except for only fair agreement between the new recombinant platform, PAX, to IDAT.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 2:30 PM

37: Influence of maropitant citrate on intradermal test reactivity in atopic dogs

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Abstract: Maropitant citrate (Cerenia®, Zoetis; Kalamazoo, MI, USA) is a neurokinin-1 receptor antagonist that inhibits binding of substance P and is approved to prevent acute emesis and motion sickness in dogs. Many medications interfere with intradermal test (IDT) results. It is unknown if maropitant citrate alters intradermal reactivity. The purpose of this study was to assess the influence of maropitant citrate on IDT in canines with atopic dermatitis. Twenty client-owned dogs with atopic dermatitis were enrolled in a randomized, controlled, blinded, cross-over study. All dogs were sedated for IDT using intravascular dexmedetomidine (2.87–5.22 mcg/kg). Each IDT was read independently by a dermatology resident and a veterinary dermatologist. Four allergens with strong positive reactions were selected for assessment in the next phase. Following completion of IDT, maropitant citrate (1 mg/kg) was administered intravenously over two minutes. The four strong positives were randomized and injected in triplicate, while histamine and saline were injected in duplicate. Subjective (0–4) and objective (mm diameter) wheal scores were measured at 15 minutes. The histamine (objective mean difference (MD)=1.1 mm, p=0.010) and positive allergen (objective MD=0.4 mm, p=0.007; subjective MD=0.2 p<0.001) wheal sizes were statistically higher post-maropitant citrate. The proportion of positive allergen scores was not significantly different post-maropitant citrate (objective 48/80 pre vs 56/80 post, p=0.094; subjective 80/80 pre vs 77/80 post, p=0.25). No adverse events were observed. In conclusion, intravascular maropitant citrate interferes with IDT in dogs by increasing wheal size, however it is equivocal if it affects clinical outcomes of allergen selection.

Conflict of interest: None declared.

Source of funding: Study funded by Stallergenes Greer; Maropitant citrate (Cerenia®, Zoetis; Kalamazoo, MI, USA) was generously donated by Zoetis.

MONDAY, APRIL 28, 2025 | 2:45 PM

43: Staphylococcus pseudintermedius, Staphylococcus aureus, and Malassezia pachydermatis reactivity on intradermal allergy testing in atopic dogs

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Abstract: Staphylococcal hypersensitivity is well-documented in humans. Evidence of its existence in dogs is scant. The primary aim of this retrospective study was to evaluate if dogs with atopic dermatitis demonstrated staphylococcal hypersensitivity on intradermal testing (IDT). The secondary aims were to see if *S. pseudintermedius* reactivity occurred more frequently than *S. aureus* and if dogs who reacted positively to another skin commensal, *M. pachydermatis*, were more likely to react to staphylococci. Between 2015-2024, dogs (n=195) with atopic dermatitis underwent multi-allergen IDT, including with extracts of *S. pseudintermedius*, *S. aureus* (for both, 1/10 of stock preparation), and *M. pachydermatis* (1,000 PNU/mL). Results were scored 0-4 with negative control being 0, positive control being 4, and wheals larger than positive control being 5. Forty-eight (24.6%) dogs were positive to *S. pseudintermedius* only; six (3.1%) were positive to *S. aureus* only, and 19 (9.7%) were positive to both. Positive reactions to *M. pachydermatis* were seen in 64 dogs (32.8%). *M. pachydermatis*-positive individuals were no more likely to test positive to staphylococci (odds ratios of 1.19-1.58, p=0.82-0.16). Regarding the relative strengths of the positive reactions, there was slight agreement between positive reactions to *M. pachydermatis* and *S. aureus* (weighted kappa=0.045), slight agreement between positive reactions to *M. pachydermatis* and *S. pseudintermedius* (weighted kappa=0.11), and fair agreement between positive reactions to *S. aureus* and *S. pseudintermedius* (weighted kappa=0.25). This study provides evidence that staphylococcal hypersensitivity is common in atopic dogs, is more common to *S. pseudintermedius*, and that its occurrence is independent of yeast hypersensitivity.

Source of funding: Self-funded.
Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 3:00 PM

28: Use of the Health Belief Model to assess factors associated with owner persistence to allergen-specific immunotherapy recommendations

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Abstract: Allergen-specific immunotherapy (ASIT) is the only recognized method for addressing the root cause of canine atopic dermatitis; however, little is known about the factors influencing persistence with ASIT, which may be suboptimal. This study aimed to identify factors influencing pet Owners 'persistence with ASIT using the Health Belief Model (HBM). We hypothesized that perceived efficacy, cost, and ease of administration would significantly impact persistence. A study pool was identified across four dermatology practices by searching electronic medical records for ASIT prescriptions from January 1, 2020-May 31, 2024. An anonymous HBM-based survey was emailed to these clients. The survey assessed client knowledge of ASIT, perceived severity, susceptibility, benefits, barriers, self-efficacy, and social support on a 5-point Likert scale. Constructs were evaluated against demographics and refill behavior using Cronbach's Alpha for reliability, Chi-square tests, and logistic regression. Acceptable reliability ($\alpha \approx 0.7–0.8$) was demonstrated for constructs measuring perceived benefits and barriers. Significant positive associations with persistence included baseline quality of life ($p=0.0013$), symptom severity ($p=0.0012$), belief that environmental allergies caused symptoms ($p=0.0075$), and perceived value of ASIT ($p<0.0001$). Conversely, cost-related barriers ($p<0.000001$) and administration difficulty ($p<0.0001$) were strong negative predictors of persistence. Perceived lack of efficacy in symptom improvement was also associated with discontinuation ($p<0.0001$). These findings emphasize the need for targeted education on ASIT's purpose, effectiveness, and cost management strategies to support persistence and optimize patient outcomes, potentially guiding future interventions in veterinary dermatology.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 3:15 PM

49: Identifying inflammatory γδ T cells in skin of atopic dogs using RNAscope

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Abstract: Canine atopic dermatitis is a common, chronic, and predominantly T cell driven inflammatory skin disease. Currently, there is an incomplete understanding of the cellular and molecular contributors to its pathogenesis. In a recent single cell RNA sequencing study, a higher number of $CD4^-/CD8^-$ γδ T cells were identified in the inguinal skin of atopic dogs compared to healthy dogs, with many inflammatory genes upregulated, including Interleukin(IL)-17F, and IL-23R. Although previously shown to infiltrate the canine skin, the specific location of γδ T cells expressing specific inflammatory genes has not been demonstrated. RNAScope® (ACD Newark, CA, USA) is a non-radioisotopic RNA *in situ* hybridization technology that uses a specific sequence probe to identify targeted mRNA. This study aimed to use RNAScope® probes, to identify and visualize specific inflammatory IL-17 and IL-23R expressing γδ T cells within atopic skin. One skin biopsy was collected from the inguinal area of two normal dogs. One lesional and one nonlesional skin biopsy was collected from the inguinal area of three atopic dogs. The biopsies were sterilely sectioned with a scalpel blade. One section of each biopsy was placed in formalin for 24 hours and paraffinized for RNAScope® *in situ* hybridization. The other section was frozen for antibody staining. In conclusion, inflammatory γδ T cells were found preferentially distributed within the epidermis of atopic tissue rather than at the dermal-epidermal junction or the dermis. This is the first study to create a visual of IL-17 and IL-23R expressing γδ T cells in canine skin using RNAScope®.

Conflicts of interest: None declared.

Source of funding: Self-funded.

MONDAY, APRIL 28, 2025 | 3:30 PM

52: Adverse events and clinical efficacy of oclacitinib in cats: a retrospective analysis

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Abstract: Oclacitinib (Apoquel®, Zoetis; Parsippany-Troy Hills, NJ, USA) is a Janus kinase inhibitor approved for canine atopic dermatitis that is gaining interest as a therapeutic alternative for feline atopic skin syndrome (FASS) and feline immune-mediated dermatoses. Long-term safety and efficacy of oclacitinib in cats has not been assessed. The main objective of this study was to describe adverse events in 238 cats treated with oclacitinib from August 2014 to September 2024 and secondarily evaluate dosing and clinical outcome. Probable or definitive adverse events occurred in 31/238 cats (13%), totaling 32 events. Adverse events likely associated with oclacitinib included: vomiting (2.5%), diarrhea (1.3%), constipation (0.4%), lethargy (1.7%), and behavioral (0.4%). Hematochemical analyses were performed at approximately 2, 5, and regular 6-month intervals. There were 139/238 cats (58%) maintained on oclacitinib for greater than six months and 94/238 cats (40%) had at least six months of bloodwork available. Probable hematologic adverse events included neutropenia (6.3%), elevated liver enzymes (0.4%), and azotemia (0.4%). In cases of neutropenia, 2/15 cats required oclacitinib discontinuation, 11/15 improved with a dosage adjustment, and 2/15 remained stable without adjustments. Oclacitinib monotherapy controlled clinical signs in 140/238 cats (59%), including 136/214 cats (64%) with FASS ($\bar{x}$=1.56mg/kg/day per os) and 5/17 cats (29%) with pemphigus foliaceus ($\bar{x}$=1.58mg/kg/day per os). Oclacitinib appears to be a safe and effective long-term therapy in cats.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 3:45 PM

38: Prevalence of keratoconjunctivitis sicca in dogs diagnosed with atopic dermatitis

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Abstract: Ocular comorbidities are increasingly recognized in association with atopic dermatitis (AD) in both humans and dogs. Between 20% to 43% of people with AD have ocular involvement, with 95% of those cases being atopic keratoconjunctivitis. In dogs, allergic conjunctivitis is reported in up to 60% of AD cases, while keratoconjunctivitis sicca (KCS) is reported in 0.4 % of the general canine population. The purpose of this study was to assess the prevalence of KCS in dogs diagnosed with AD. We hypothesized that the prevalence would be higher than that of the general population. Fifty client owned dogs diagnosed with AD based on history, clinical signs, completion of an elimination diet trial, and fulfillment of at least five of Favrot's criteria were recruited for evaluation. KCS was diagnosed based on a Schirmer Tear Test (STT) value of less than 10 millimeters per minute (mm/min) using EagleVision® Color Bar STT strips (Corza Medical, NJ, USA). Three dogs were withdrawn for not tolerating the STT. Of the remaining 47, one was diagnosed with KCS and two showed STT values in the low normal range (10-14 mm/min). These results did not support our hypothesis that dogs with AD would have a higher prevalence of KCS compared to the general canine population (p=0.172). However, due to the low overall prevalence of KCS in dogs, it is possible that a larger number of patients may be required to detect a statistically significant increase in prevalence of KCS in this subpopulation.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 4:30 PM

30: Stability and minimum inhibitory concentrations of compounded ceftazidime in sodium chloride, glycerin, and dexamethasone-SP solutions stored at –20°C, 4°C, and 25°C over a 60-day period

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Abstract: Chronic canine otitis externa often develops infection with *Pseudomonas aeruginosa*. Given the organism's high level of resistance, veterinarians often turn to compounded solutions. Limited data is available on compounded ceftazidime solutions in glycerin (GLY) and dexamethasone sodium phosphate (DEX-SP). The aim of this study was to determine the chemical stability and antimicrobial efficacy of compounded GLY and DEX-SP ceftazidime solutions in three different storage temperatures (frozen [-20ºC], refrigerated [4ºC], and room-temperature [25ºC],) over a 60-day period. Commercially available 1-gram vials of ceftazidime were reconstituted to formulate compounded solutions: 1) Ceftazidime + 100 mLs 0.9% NaCl (NA), 2) Ceftazidime + 100 mLs 99.5% GLY, 3) Ceftazidime + DEX-SP 4 mg/mL (50 mL DEX-SP mixed with 50 mL of 0.9% NaCl) that were stored in 1.0 mL aliquots. Mass spectrometry was used to analyze ceftazidime stability at specific time points (D0, D7, D14, D28, D60). Minimum inhibitory concentrations (MIC) against a reference *Pseudomonas aeruginosa* strain were assessed using a modified broth dilution technique to evaluate antimicrobial efficacy. Frozen samples remained stable, while all 4ºC and 25ºC samples regardless of diluent showed degradation over time. The NA and DEX-SP solutions revealed the greatest stability over time, while the GLY solution showed the least stability ($p<0.0001$). The MIC for *Pseudomonas aeruginosa* increased over time for GLY at room temperature after D28. Compounded ceftazidime solutions with NA or DEX-SP retained stability for 28 days at 4ºC and 60 days at -20ºC which may offer alternative options for treatment of *Pseudomonas aeruginosa* otitis externa.

Source of funding: Self-funded.
Conflict of Interest: None declared.

MONDAY, APRIL 28, 2025 | 4:45 PM

57: Evaluation of compatibility and stability of compounded otic solutions containing enrofloxacin over a 20 day period

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Abstract: Compounded otic solutions containing enrofloxacin are commonly used in the management of otitis. The study objective was to evaluate the compatibility and stability of enrofloxacin in compounded otic solutions, as determined by physical changes and quantitated strength. Twelve solutions containing 100 mg/mL enrofloxacin (Baytril® 100, Elanco) or 22.7 mg/mL enrofloxacin (Baytril®, Elanco) were quantitatively analyzed on days 0, 10, 15, and 20. Both concentrations of enrofloxacin were combined with sterile water (Hospira), tris-EDTA (TrizEDTA™, Dechra), sterile water and 4 mg/mL dexamethasone sodium phosphate (dexamethasone; Dexium-SP™, Bimeda), tris-EDTA and dexamethasone, tris-EDTA with 0.15% ketoconazole (TrizULTRA™ Keto, Dechra) and dexamethasone, and 1% miconazole nitrate lotion (Covetrus) and dexamethasone. Gross and microscopic evaluation, pH, and temperature were used to assess physical compatibility. Mass spectrometry was used to evaluate precipitate. High-performance liquid chromatography was used to quantitate drug concentration, indicating strength. Initial separation of ingredients indicating lack of homogenous mixing, immediate precipitate formation, and an exothermic reaction deterred drug strength measurement in solutions containing an antifungal. On day 10, in solutions containing tris-EDTA, average enrofloxacin concentration decreased 25.4% with 100 mg/mL enrofloxacin, 29.3% with 100 mg/mL enrofloxacin and dexamethasone, 45.6% with 22.7 mg/mL enrofloxacin, and 49.8% with 22.7 mg/mL enrofloxacin and dexamethasone. Precipitate formed in all solutions containing tris-EDTA and filtration of the precipitate did not impact the measured enrofloxacin concentration. Compatibility and stability of enrofloxacin were verified in all solutions containing sterile water. Clinical use of solutions containing enrofloxacin combined with tris-EDTA or an antifungal is injudicious due to incompatibility and instability.

Conflict of interest: None declared.

Source of funding: Intramural grant from the Auburn University College of Veterinary Medicine Department of Clinical Sciences.

MONDAY, APRIL 28, 2025 | 5:00 PM

7: Suppurative *Malassezia* otitis externa: a descriptive retrospective analysis

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Abstract: Suppurative *Malassezia* otitis externa (SMO) is a rare, severe presentation of *Malassezia* otitis with a paucity of literature describing disease course. Medical records from nine client-owned dogs with SMO and culture confirmed *Malassezia pachydermatis* were retrospectively evaluated for signalment, SMO distribution, contralateral otitis, duration prior to referral, previous topical and systemic antimicrobial treatment, seasonality, otoscopic and cytologic findings, treatment, and recurrence. Three banked SMO isolates were mycologically identified with matrix-assisted laser desorption and ionization time-of-flight mass spectrometry confirming pathogenic *M. pachydermatis*. Median duration prior to referral was 18 months. Prior treatment included an average of two different antibiotic classes of polypharmaceutical otic products directed towards *Pseudomonas* otitis attributed to clinical mimicry of SMO. No systemic antimicrobials were used for prior treatment in any case. Young (average 1-year-old), male (67%) golden retrievers (22%), poodles (11%), and their crosses (56%) were predisposed. The most frequent clinical presentation was unilateral otitis externa (77%) consisting of dark brown watery to mucopurulent discharge with ulceration, pain, erythema, and ceruminous gland hyperplasia (100%) during autumn (75%). The contralateral ear either remained unaffected (50%) or had *Malassezia* overgrowth (50%). Cytologic findings included yeast, neutrophils, and extracellular material suggestive of biofilm (100%). Treatment with both daily orbifloxacin, mometasone furoate monohydrate, and posaconazole (Posatex®, Merck Animal Health; Madison, NJ, USA) and tapered prednisone (0.5-1 mg/kg/day) per os for one month achieved complete resolution in 83% of affected ears without anesthetized otic lavage. Prognosis is considered excellent without recurrence of any case within at least six months of treatment.

Source of funding: Self-funded.

Conflict of interest: None declared.

MONDAY, APRIL 28, 2025 | 5:15 PM

46: Practitioner-reported diagnosis and awareness of coccidioidomycosis in dogs from non-endemic states, 2013-2023

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Abstract: Center for Disease Control defines coccidioidomycosis ("Valley Fever") as a human endemic disease in the southwestern United States spreading into non-endemic regions. Dogs and people develop coccidioidomycosis primarily by inhaling infected spores; therefore, dogs could act as sentinels for disease. This study aimed to understand how often veterinary practitioners diagnosed coccidioidomycosis in non-endemic states, and to determine if travel history to endemic states correlated with diagnosis. The secondary objective compared the awareness and knowledge of coccidioidomycosis among veterinarians in endemic verses non-endemic states. Practitioners were surveyed through Veterinary Information Network (VIN) in June - August 2024. Responses (n=616) were sorted by veterinarian's state of practice at the point of the survey wherein states were classified as endemic vs non-endemic. The survey identified 251 responses from non-endemic states. Direct contact with 150 veterinarians for further medical record review revealed seven cases had travel history to an endemic state prior to diagnosis, and one case was positive without travel history. Veterinarians (62.1%) reported veterinary school as the source of their coccidioidomycosis education. Veterinarians from endemic states had higher awareness of coccidioidomycosis (26.2% vs 15.2%), diagnosed coccidioidomycosis more often (46.9% vs 3%), and had more reported hours of didactic training (21.2% vs 9.8%). The results of this study requires further evaluation to determine if dogs are sentinels for disease, but this is the first study to the authors' knowledge that indicates a coccidioidomycosis diagnosis in a non-endemic area without travel history, and warrants further education of coccidioidomycosis diagnosis in non-endemic regions.

Source of funding: There was no funding for this paper.

Conflict of interest: None declared.

PRESENTATION SCHEDULE

TUESDAY APRIL 29, 2025

SCIENTIFIC NOTES | LOCATION: WINDERMERE BALLROOM W

09:00 - 09:50	Dr. Mark Papich	**Measuring MIC and Clinical Breakpoints for Veterinary Antibiotics - Essential to Antibiotic Stewardship**
10:00 - 10:50	Dr. Mark Papich	**Why Have Susceptibility Testing Breakpoints Changed for Veterinary Antibiotics?**
11:30 - 12:20	Dr. Nikki Thellman	**Clinical Investigation and Biomarker Discovery in Early Drug Development for Allergic Dermatitis Part 1 - Introduction to Biomarkers and Molecular Advancements**
14:00 - 14:50	Dr. Nikki Thellman	**Clinical Investigation and Biomarker Discovery in Early Drug Development for Allergic Dermatitis Part 2 - Biomarkers and Translational Biology in Allergic Dermatitis**
15:00 - 15:50	Dr. Cheryl London	**Defining the Genomic Landscape of Canine Cancers**
16:30 - 17:20	Dr. Cheryl London	**Advances in the Diagnosis and Treatment of Canine Cutaneous T Cell Lymphoma**

CLINICAL NOTES | LOCATION: WINDERMERE BALLROOM X

09:00 - 09:50	Prof. Ross Bond	**Malassezia Review - Part 1**
10:00 - 10:50	Prof. Ross Bond	**Malassezia Review - Part 2**
11:30 - 12:20	Prof. Ross Bond	**Pitfalls in the Diagnosis of Dermatophytosis**
14:00 - 14:50	Dr. Clarissa Souza	**Sporotrichosis: Epidemiological and Clinical Approach**
15:00 - 15:50	Dr. Flávia Clare	**Clinical Brazilian Perspective**
16:30 - 17:20	Prof. Ross Bond, Dr. Clarissa Souza & Dr. Flávia Clare	**Panel Discussion: Emerging Fungal Diseases in Human and Veterinary Medicine**

PRESENTATION SCHEDULE

SPANISH / CLINICAL NOTES | LOCATION: REGENCY BALLROOM V

09:00 - 09:50	Dr. Agustina Anson & Dr. Ramon Almela	**El papel del radiologo en dermatología veterinaria**
10:00 - 10:50	Dr. Agustina Anson & Dr. Ramon Almela	**Radiología y Dermatología: Un Enfoque Colaborativo**
11:30 - 12:20	Dr. Galia Sheinberg	**Terapia tópica exitosa: cómo mejorar los resultados en casos complejos**
14:00 - 14:50	Dr. Millie Rosales	**¿Los gatos pueden tener alergias? Signos, tipos y tratamientos**
15:00 - 15:50	Dr. Andrea Hernandez-Bures	**Manejo de Pénfigo Foliáceo Canino en la Práctica Veterinaria: Terapias Efectivas y Avances**
16:30 - 17:20	Dr. Alberto Martin Cordero	**Los 10 si y no de la Otitis externa**

PRESENTATION SCHEDULE

RESIDENT ABSTRACTS | LOCATION: REGENCY BALLROOM T

09:15 - 09:50	Mrs. Letitia Grant	**The Effect of Daily Oral Probiotic and Postbiotic Supplementation on the Canine Skin Microbiota: Insights from Culture-Dependent and Long-Read 16S rRNA Gene Sequencing Methods**
09:15 - 09:30	Dr. Morgan Mathai	**Clinical and histopathologic features of canine alopecia areata: a retrospective study of 14 cases**
09:30 - 09:45	Dr. Morgan Mathai	**Microarray gene expression analysis of lesional skin in canine alopecia areata**
09:45 - 10:00	Dr. Jyothi Surendran	**Agreement between pre-consultation client filled history questionnaire responses and verbal history during a veterinary dermatology consultation**
10:00 - 10:15	Dr. Joseph Cordonier	**Informant discrepancy in history reporting between caretakers in veterinary dermatology**
10:15 - 10:30	Dr. Monica (Jiwon) Kim	**Clinical and histopathological features of presumed follicular dysplasia in poodle crossbred dogs (doodle follicular dysplasia)**
10:30 - 10:45	Dr. Lydia Smith	**Clinical, histopathological and molecular characterization of canine epitheliotropic cutaneous T-cell lymphoma enriched with apoptotic keratinocytes: a retrospective case series**
10:45 - 11:00	Dr. Rachel Dubin	**Parakeratotic hyperkeratosis of the ear pinnae in 16 French bulldogs**
11:30 - 11:45	Dr. Taylor Jackson	**A retrospective analysis of cases of canine cutaneous toxic shock syndrome for clues to facilitate an early diagnosis**
11:45 - 12:00	Dr. Dalia Aoudj	**Fluorescent light energy as a treatment of Alopecia X: a prospective randomized double-blinded pilot study**
12:00 - 12:15	Dr. Tori Cleaver	**Comparison of Fabric Photoprotective Clothing for Reduction of Ultraviolet (UVA and UVB) Radiation**
12:15 - 12:30	Dr. Averi Kaplan-Hsu	**Amphibians with dermatological disease: a retrospective study of 223 cases at five university veterinary teaching hospitals (1986-2024)**

PRESENTATION SCHEDULE

ORIGINAL ABSTRACTS | LOCATION: REGENCY BALLROOM T

14:00 - 14:15	Dr. Annette Lundberg	**Effect of fluorescence photobiomodulation on canine progenitor epidermal keratinocytes with and without Staphylococcus pseudintermedius colonization**
14:15 - 14:30	Ms. Gianna Goldman	**In vitro evaluation of the antimicrobial activity of chlorhexidine alone or in combination with ketoconazole or miconazole against clinical isolates of multidrug resistant Staphylococcus pseudintermedius**
14:30 - 14:45	Ms. Hee Woo Cha	**Effects of heavy metals as environmental factors in canine atopic dermatitis**
14:45 - 15:00	Dr. Michaela Austel	**Comparison of intradermal allergy testing with and without fluorescein and serum allergy testing in 10 cats with feline atopic skin syndrome oro**
15:00 - 15:15	Dr. Rosanna Marsella	**Characterization of a Monoclonal Antibody Against Equine IL-31**
15:15 - 15:30	Dr. Maiara Goncalves Ramos	**In situ hybridization for the identification of mammalian pathogenic oomycetes in formalin-fixed and paraffin-embedded specimens**
15:30 - 15:45	Dr. Kaylie Zapanta	**The bacteriome and mycobiome of the bearded dragon (Pogona vitticeps) across cloacal, oral, and cutaneous sites using Next-Generation Sequencing**
15:45 - 16:00	Ms. Jazreeet Badhesha	**Infectious diseases in dermatology – A comparative analysis shows major differences in research priorities**

CLINICAL ABSTRACTS | LOCATION: REGENCY BALLROOM T

16:30 - 16:45	Dr. Jennifer Forney	**Results of a clinical study evaluating the efficacy and safety of Apoquel Chewable® tablets for the control of pruritus associated with allergic dermatitis in dogs**
16:45 - 17:00	Dr. Andrew Rosenberg	**Evaluation of antibody levels and clinical response to transdermal immunotherapy in dogs: a pilot study**
17:00 - 17:15	Dr. Jason Pieper	**The role of comorbidities in pyoderma among canine and feline diabetic patients: beyond diabetes**
17:15 - 17:30	Dr. Breanna Scranton	**Treatment of canine pemphigus variants with oclacitinib: a retrospective analysis of 20 cases**

TUESDAY, APRIL 29, 2025 | 9:00 AM

Measuring MIC and Clinical Breakpoints for Veterinary Antibiotics – Essential to Antibiotic Stewardship –

MARK G. PAPICH, PROFESSOR OF CLINICAL PHARMACOLOGY

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The Clinical and Laboratory Standards Institute (CLSI) Veterinary Antimicrobial Susceptibility Testing (VAST) subcommittee has been active since 1993. Before VAST developed veterinary-specific breakpoints, all susceptibility testing for bacteria isolated from animals used human standards (M100, available from www.CLSI.org). Testing standards for bacteria isolated from animals were needed to provide the best guidance for drug selection, interpretation, and monitoring programs. The latest published veterinary standard is the 7th edition (CLSI VET01(S), 2024). This document has tables with antimicrobial agents recommended for testing, interpretive categories and breakpoints, and quality control (QC) ranges. A new edition of this standard (8th Edition) will be published late 2025 or early 2026. The VAST subcommittee has developed breakpoints for 268 drug-bug combinations since 1999. Many of the breakpoints (40%) were developed by the Generic Drug Working Group to add and update older agents and add human antimicrobial agents used in animals extralabel to these tables.

The mission of CLSI-VAST is to develop and promote performance standards, breakpoints, and interpretive categories for in vitro antimicrobial susceptibility testing of bacteria isolated from animals. Participation in VAST is entirely voluntary. Not all laboratories use CLSI standards. However, it is the only global organization with published susceptibility testing standards for animals. (The European veterinary subcommittee of EUCAST, VetCAST has not published any standards for interpretation at this time.) If a laboratory does not adhere to a public standard such as CLSI, susceptibility testing interpretation may be inconsistent from laboratory to laboratory and between countries.

All members of CLSI-VAST are volunteers. The committee is composed of representatives from industry, microbiology laboratories, device manufacturers (susceptibility testing companies), government (regulatory), and professions (academia). CLSI uses a consensus-driven process and open meetings to develop

standards for testing. The committee is continuously evaluating existing interpretive categories and breakpoints for refinement and revision. The following sections define the activities of CLSI-VAST and explains how they develop antimicrobial susceptibility testing standards.

First, Some Definitions.

1. Minimal Inhibitory Concentration (MIC): The lowest concentration that inhibits visible bacterial growth. Other terms used to define bacterial susceptibility are the MIC_{50} and the MIC_{90}. These values are the in vitro concentrations needed to inhibit 50% and 90% of bacterial isolates, respectively. It is sometimes cited in error that the MIC_{50} and MIC_{90} are the concentrations necessary for 50% and 90% efficacy.

2. C_{MAX}:MIC: Ratio of the maximum plasma concentration (peak) to the MIC.

3. Time above MIC: Duration (hour) that plasma concentrations remain above MIC during a 24 hour dosing interval. Often abbreviated as T>MIC.

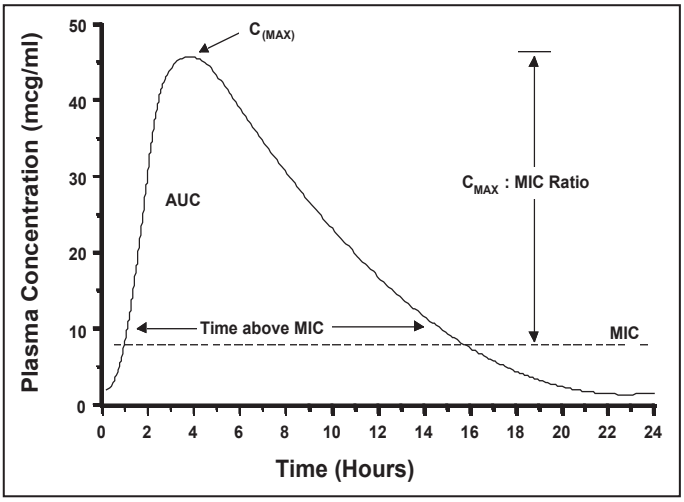

Figure 1: PK-PD concepts for antimicrobials.

4. AUC:MIC: A measure of total exposure. The AUC is the area-under-the-curve for the time vs concentration profile. The AUC:MIC ratio is the ratio of the total area under the plasma concentration vs time curve (AUC) during a 24-hour interval to the MIC. Sometimes abbreviated as AUC_{24}/MIC.

More Definitions: Susceptibility Testing Interpretive Categories

Resistance and susceptibility (R and S) are determined by comparing the organism's MIC (or zone of inhibition) to the drug's breakpoint. In Table 2 of the CLSI VET01(S) standard, the interpretive categories for the MIC are shown, which defines the susceptible and resistant breakpoints. After a laboratory determines the MIC, it uses the "SIR" interpretive categories for breakpoints (S, susceptible; I, intermediate, R, resistant; or SDD, susceptible dose-dependent) developed by the Clinical Laboratory Standards Institute and reports the result to the user (the veterinarian). MIC data should not be used

in isolation. By coupling the MIC from a laboratory report with CLSI interpretive categories and other important information such as the virulence of the bacteria and the pharmacology of the antibiotics being considered, the clinician can make a more informed selection of an antibacterial drug. The following guidelines for interpretation apply:

- **Susceptible (S)** – a category based on a breakpoint that implies that isolates are inhibited by the usually achievable concentrations of antimicrobial agent when the dosage recommended to treat the site of infection is used. If the MIC for the bacterial isolate falls in the *susceptible category*, there is a greater likelihood of successful treatment (cure) than if the isolate were classified as resistant. It does not assure success; drug failure is still possible owing to other drug or patient factors (eg, underlying disease, or immunosuppression), and interactions.

- **Intermediate (I)** – a category based on a breakpoint that includes isolates with antimicrobial agent MICs that approach usually attainable blood and tissue levels and for which response rates may be lower than for susceptible isolates. Therapy with this drug using an accepted dosage is discouraged because there is a good likelihood that drug concentrations may be inadequate for a cure. The intermediate category implies clinical efficacy in body sites where the drugs are physiologically concentrated or when a higher-than-normal dosage of a drug can be used. *(Note* that the European equivalent of CLSI, EUCAST, uses "I" to mean "increased dose".) This category also includes a buffer zone, which should prevent small, uncontrolled, technical factors from causing major discrepancies in interpretations, especially for drugs with narrow pharmacotoxicity margins.

- **Susceptible-Dose Dependent (SDD)** – This new category was added in the new edition of 2024 (Papich et al. 2023). This is a category defined by a breakpoint that implies that susceptibility of an isolate depends on the dosage regimen that is used in the patient. This category is used for some fluoroquinolones and applied to other agents in the next edition. To achieve levels that are likely to be clinically effective against isolates for which the susceptibility testing results (either MICs or zone diameters) are in the SDD category, it is necessary to use a dosage regimen (ie, higher doses, more frequent doses, or both, or extended infusion) that results in higher drug exposure than that achieved with the dose that was used to establish the susceptible breakpoint. Consideration is given to the maximum safe dose the manufacturer has reported.

- **Resistant (R)** – a category based on a breakpoint that implies that isolates are not inhibited by the usually achievable concentrations of the agent with normal dosage schedules and/or that demonstrate MICs that fall in the range in which specific microbial resistance mechanisms are likely, and clinical efficacy of the agent against the isolate has not been reliably shown in treatment studies. Bacteriologic failure is more likely because of specific resistance mechanisms or

inadequate drug concentrations in the patient. However, a patient with a competent immune system may sometimes eradicate an infection even when the isolate is resistant to the drug based on a susceptibility test.

Wild Type *vs* Non-Wild Type

- **Wildtype (WT)** – a category based on an epidemiological cutoff value (ECOFF) that describes isolates with no mechanisms of acquired resistance or reduced susceptibility for the antimicrobial (antibacterial or antifungal) agent being evaluated.

- **Non wildtype (NWT)** – a category based on an epidemiological cutoff value that describes isolates with presumed or known mechanisms of acquired resistance and reduced susceptibility for the antimicrobial (antibacterial or antifungal) agent being evaluated.

  Bacteria can be classified as “wild-type” or “non-wild-type”. The distinction is that wild-type (WT) describes bacteria isolates with no phenotypically detectable mechanisms of acquired resistance or reduced susceptibility for the antimicrobial agent being evaluated. Non-wild-type (NWT) bacteria describes isolates with presumed or known mechanisms of acquired resistance and reduced susceptibility for the antimicrobial agent being evaluated. These are defined by phenotypic characteristics (MIC values) not through genetic testing. The wild-type cutoff does not necessarily align with the clinical breakpoint (Figure 2); although sometimes they may agree.

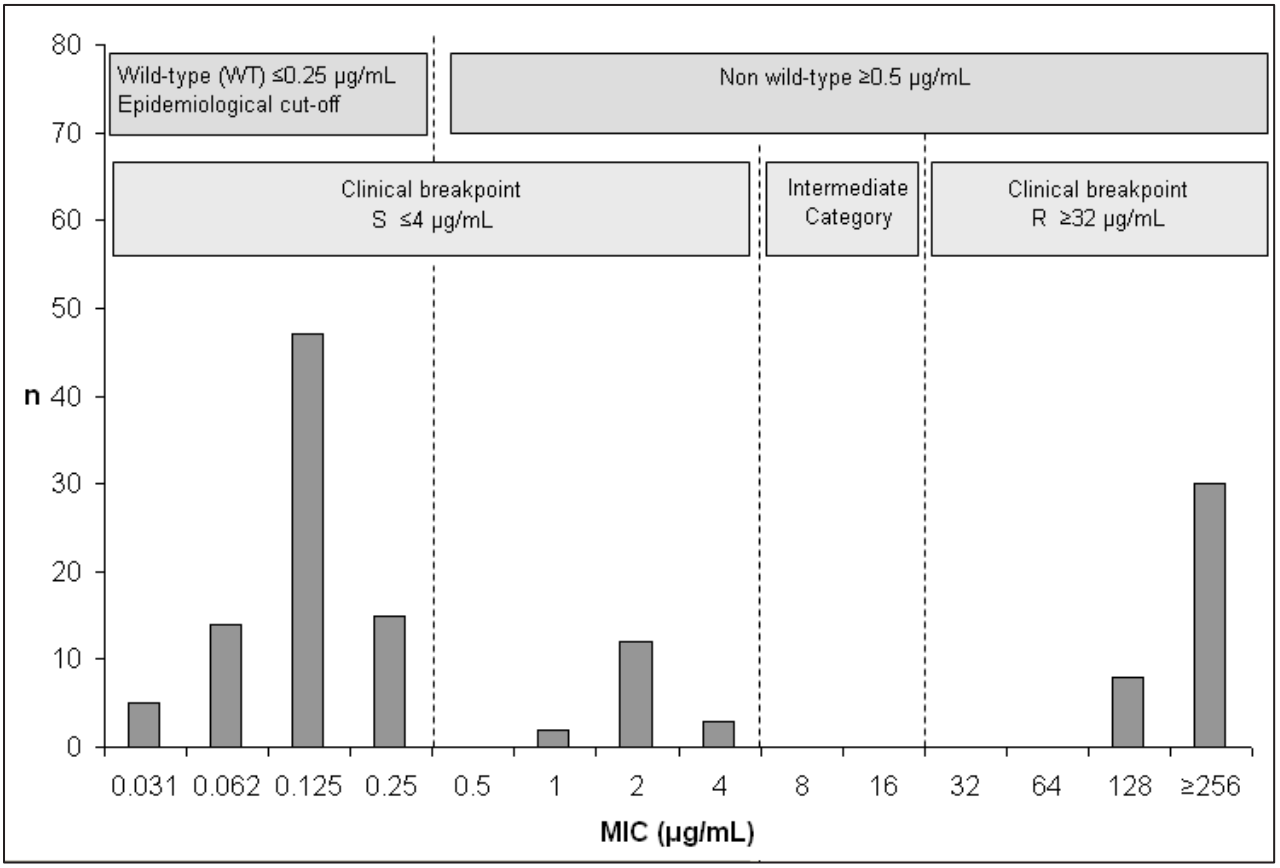

Figure 2: Example of Wild-Type vs Non-Wild Type Distribution

Bactericidal Vs Bacteriostatic Antibiotics:

Whether an antimicrobial agent is bactericidal or bacteriostatic has no bearing on the susceptibility testing interpretive category or breakpoint. Some drugs have been classified as bactericidal and others are bacteriostatic and for some drugs it is variable. This is actually an arbitrary distinction, developed using *in vitro* measurements. Using log-kill studies in the laboratory, these assays test the concentrations that reduce the bacterial count over time in an animal infection model or an *in vitro* assay. The results are expressed as the decline in colony forming units (CFU) in laboratory infection models or *in vitro* assays, usually expressed as net bacterial stasis, 1-$\log_{10}$ reduction, 2-$\log_{10}$ reduction, or 3-$\log_{10}$- reduction in bacterial counts. A 3-$\log_{10}$ reduction is considered bactericidal because it represents a decrease by 1,000x or killing 99.9% of the bacteria. Reductions less than this value are still accepted for clinical treatment. A 1-log reduction is sufficient for a successful outcome. Although laboratories have used these tests to classify some antimicrobials are *bactericidal* and *bacteriostatic,* this is a laboratory test and may not translate to effects of the drug in the patient.

Which is better?

The clinical importance of bacteriostatic vs bactericidal has been exaggerated and should not affect your choice of antimicrobial agents. Some drugs produce both effects, depending on the concentration and species of bacteria. It was once assumed that immunosuppressed patients (eg, some neonates, immunocompromised foal, FeLV positive cat) require bactericidal treatment. However, this is not confirmed in clinical studies. In human medical studies and reviews there has been no difference in outcome between bactericidal and bacteriostatic agents, including patients receiving immunosuppressive drugs (anticancer drugs).

Does it matter?

No. There is no evidence of a clinical difference between *bacteriostatic* and *bactericidal* antibiotics. Drugs now are usually referred to as *time-dependent* or *concentration-dependent,* which affects our dosage regimens and frequency of administration. Macrolides, chloramphenicol, and tetracyclines may actually be more bactericidal than once thought. Some older references warned clinicians to avoid simultaneously administering drugs that produce *both* a bactericidal and bacteriostatic effect, but this old recommendation is no longer supported.

PRINCPLES OF CULTURE AND SUSCEPTIBILITY TESTING:

Agar-Disk-Diffusion Test (ADD) (Kirby-Bauer Test):

This test measures the inhibition of bacterial growth against a concentration of antimicrobial that diffuses from an impregnated paper disk placed on the agar. There is a relationship between the zone size and the MIC, although direct correlations are sometimes weak. The zone size is correlated with the MIC. The larger the zone size, the lower the MIC.

Limitations of ADD test:

- The inoculation variables must be well controlled, and the test must be performed according to strict procedural standards (CLSI 2024). The precise depth of the agar, incubation time (usually 18 to 24 hours), and selection and preparation of the agar are important. Interfering compounds should be known. For example, the agar should be free of PABA, which interferes with the susceptibility test for sulfonamides and free of thymidine, which interferes with the test for trimethoprim. Mueller-Hinton Agar (MHA) usually is a suitable selection for most bacteria, but special media is needed for some bacteria (eg, VFM, or veterinary fastidious media).
- Reading zone sizes: Each antibiotic diffuses at different rates throughout the agar;

therefore, one must use published standards (CLSI, 2024) for interpreting the susceptibility based on zone diameter.

MIC Determination (Dilution Test, or Microdilution Test):

Many laboratories directly measure the minimum inhibitory concentration (MIC) of an organism using the antimicrobial dilution test. Zone inhibition provides only qualitative information. The MIC dilution test is conducted by inoculating the wells of a plate with the bacterial culture and dilutions of antibiotics are arranged across the rows. In modern laboratories, the test is usually performed using high-throughput plates, but individual tubes or plates can be used for dilution tests also. The MICs are determined using serial two-fold dilutions (Log 2) of drug to which is added a standardized inoculum that is incubated for a prescribed time. Concentrations are always reported in µg/mL, or mg/L. The lower the MIC value, the more susceptible the bacterial isolate is to that drug. Concentrations are listed in µg/mL (or mg/L). For example, if one were to start at a concentration of 256 µg/ml, the MIC dilution series would be as follows: 128, 64, 32, 16, 8, 4, 2, 1, 0.5, 0.25, 0.12, and 0.06 µg/ml, etc. If, for example, bacterial growth occurs at a dilution of 0.12 µg/ml for a specific drug, but not at 0.25 µg/ml and above, the MIC is determined to be 0.25 µg/ml. The MIC dilution test is only semi-quantitative because there are gaps between each dilution. Realistically, the true MIC lies somewhere between these values, but the MIC is recorded as the lowest dilution that inhibited growth. Some laboratories and research groups have used other methods to measure the MIC such as the E-test® (epsilometer test) distributed by bioMérieux. The E-test is not standardized but can obtain a quantitative measure of the MIC by direct measurement of bacterial growth along a concentration gradient of the antibiotic contained in a test strip.

The advantages of using an MIC test over the ADD test are listed below.

- This test can usually examine more antibiotics than the ADD test.
- The interpretative categories (susceptible / resistant) can be related to drug concentration; therefore, pharmacokinetic-pharmacodynamic (PK-PD) principles can be applied.
- Lower urinary tract infections (UTI): If one is treating a UTI, the MIC breakpoint for some drugs may be higher (for example, cephalosporins, amoxicillin). These agents have different urine-specific MIC breakpoints that cannot always be differentiated with a zone test.
- Better predictability: In clinical studies, a category of resistant *vs* susceptible via MIC test was a better predictor of clinical outcome than the ADD test.
- ADD test is not accurate for testing glycopeptides (vancomycin) and MIC test should be used.

Notes to remember about susceptibility testing:

- Susceptibility tests assume equal plasma and tissue concentrations of unbound drug (protein free drug).
- Susceptibility tests overestimate the antimicrobial activity in CSF, prostatic fluid, eye, and udder.
- Susceptibility tests underestimate activity of topical treatments, local infusions, and for some antimicrobial agents that concentrate in the urine. Urine exceptions include those with urine-specific breakpoints – amoxicillin, amoxicillin-clavulanate, and first-generation cephalosporins.
- Susceptibility tests usually do not test for antibiotic combinations and may miss potentially synergistic combinations (exceptions that are measured include trimethoprim-sulfonamides and amoxicillin-clavulanate).
- Susceptibility tests cannot consider the local factors that may affect antimicrobial activity such as pus, low oxygen tension, or poor blood flow to tissue.
- Although there are interpretation standards for most antibiotics used in veterinary medicine, there are a few gaps. When an interpretation is not available, we use the human interpretation categories, which may not always be accurate (*but better than nothing).*
- Susceptibility tests are used to predict therapeutic outcome in a patient; they don't predict the likelihood of resistance emerging during treatment.

Susceptibility Breakpoints for Antimicrobials Used in Animals (CLSI VET01(S) 2024)

Antimicrobial	Susceptible (µg/ml)[a]	Resistant (µg/mL)[a]
Amikacin	≤4	≥16
Ampicillin	≤ 0.25 (≤ 8 for urine)	≥0.5
Amoxicillin/Clavulanate	≤0.25/0.12. (≤ 8/4 for urine)	≥1/0.5
Cefazolin	≤2 (≤ 16 for urine)	≥8
Ceftazidime	≤4; ≤ 8 for *Pseudomonas*)	≥16; 32 for *Pseudomonas*
Cefpodoxime	≤2	≥8
Cephalexin	≤2 (≤ 16 for urine)	≥8
Chloramphenicol	≤2	≥8
Levofloxacin	≤0.5; ≤ 1 for *Pseudomonas*)	≥2; 4 for *Pseudomonas*
Doxycycline	≤0.12	≥0.5
Minocycline	≤0.5	≥2
Pradofloxacin	≤0.25	≥2
Enrofloxacin (dogs)	≤0.06 (SDD 0.12-0.25)	≥0.5
Gentamicin	≤2	≥8
Imipenem	≤1 [b]	≥4
Marbofloxacin (dogs)	≤0.12	≥0.5
Orbifloxacin	≤1	≥8
Oxacillin (veterinary)	≤0.25	≥0.5
Penicillin G (Equine)	≤0.5 (≤0.25 Bovine)	≥2.0
Piperacillin-Tazobactam	≤8/4	≥32/4
Trimethoprim/Sulfa	≤2/38 [b]	≥4/76
Vancomycin	≤2 (*Staph. aureus)* [c]	≥ 16 (*Staph. aureus)*

Footnotes:

Reference: CLSI. Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated from Animals. 7th ed. CLSI supplement VET01S. Clinical and Laboratory Standards Institute; 2024.
a. Values between the susceptible and resistant range are interpreted as "intermediate".
b. Some of the breakpoints listed are derived from human standards listed in M100.
c. Enrofloxacin and marbofloxacin breakpoints have more categories than listed in this table. There is also a susceptible dose-dependent (SDD) category that allows for higher doses. The breakpoint is different for these agents for cats vs dogs.

How are Standards Developed?

The most important information for the clinician to guide treatment is the report that informs them which drugs have an “S” and which ones have an “R”. What goes into this interpretation? The paper by Turnidge and Paterson (2007) describes the process of setting breakpoints. The CLSI-VAST uses a published guideline (VET02) to develop their standards and establish breakpoints. Sponsors (pharmaceutical companies) submitting breakpoints to CLSI follow these guidelines and submit data to support a proposed breakpoint. The data includes pharmacokinetic data in the target species, MIC distributions for the pathogens targeted, clinical data from the drug used under field conditions at the approved dose, and pharmacokinetic-pharmacodynamic (PK-PD) analysis, using Monte Carlo Simulations (Ambrose, 2006) to show that, at the approved dose, the drug attains PK-PD targets for the labeled pathogen. For older drugs that do not have active sponsors (referred to as “generic drugs” in the guidelines), or human-labeled antimicrobial agents used frequently in animals, the Generic Drug Working Group has developed breakpoints. This group developed most of the breakpoints that are listed in Table 2 for the past 20 years. For these drugs, the committee will consider less rigorous detail. For example, results from clinical use of the agent under controlled field conditions may not be available.

Are These Standards, or Guidelines?

The CLSI is a consensus-driven process and after approval by the subcommittee, the standards become public documents. The consensus process involves the development and public open review of documents, revision of documents in response to discussion, and finally, the acceptance of a document as a consensus standard or guideline.

The CLSI documents used for culture and susceptibility testing should be regarded as a public standard, not a guideline. A Standard is a document developed through the consensus process that clearly identifies specific, essential requirements for materials, methods, or practices for use in an unmodified form. A *Standard* may, in addition, contain discretionary elements, which are clearly identified. A *Guideline* is a document developed through the consensus process describing criteria for a general operating practice, procedure, or material for voluntary use. A guideline may be used as written or modified by the user to fit specific needs.

Does the susceptibility test provide tissue-specific interpretation?

The susceptibility interpretation is based on plasma/serum concentrations. There are no tissue-specific interpretations that account for differences in drug distribution among tissues (exception for urine isolates described below). In most instances, the clinician should not be concerned with the question of whether there are tissue-specific susceptibility interpretations. Antibiotic unbound drug concentrations in the serum or plasma approximate the drug concentration in the extracellular space (interstitial fluid) for most tissues. This occurs because there is no barrier that impedes drug diffusion from the vascular compartment to extracellular tissue fluid. The concept of "good penetration" and "poor penetration" when comparing antibiotics is overemphasized by many clinicians. Pores (fenestrations) or microchannels in the endothelium of capillaries are large enough to allow antibiotic drug molecules to distribute to the extracellular space unless the drug is restricted by protein binding in the blood. However, tissues lacking pores or channels may inhibit penetration of some drugs (discussed below).

If adequate drug concentrations can be achieved in plasma, there are no barriers in the tissue which will prevent drug diffusion to the site of infection if the tissue has an adequate blood supply. Therefore, clinicians should be concerned when treating tissues that have poor or impaired blood supply. Drug diffusion into an abscess or granulation tissue is sometimes a problem because in these conditions, the site of infection may lack an adequate blood supply and drug penetration relies on simple diffusion. In an abscess, there is not a physical barrier to diffusion, but low drug concentrations can occur because of poor blood perfusion and drug concentrations are slow to accumulate.

For some tissues, a lipid membrane (such as tight junctions on capillaries) can present a barrier to drug diffusion. In these instances, a drug must be sufficiently lipid-soluble or actively carried across the membrane by transporters to reach an effective concentration in tissues. These tissues include: the central nervous system, eye, and prostate. There also is a barrier between plasma and bronchial epithelium (blood-bronchus barrier). This limits drug concentrations of some drugs in the bronchial secretions and epithelial fluid of

the airways. However, this barrier may be compromised during infection (pneumonia), which allows many antimicrobial agents to reach effective concentrations in pneumonic lungs.

Exception for Urine Isolates. Even though many antibiotics concentrate in the urine – which is beneficial for treating a urinary tract infection – the susceptibility testing interpretive categories are based on achieving adequate concentrations in the blood. For drugs excreted in the urine in an active form, CLSI allows exceptions for interpretation of some drugs. In the current veterinary standards (CLSI, 2024), there are separate clinical breakpoints for urine isolates of the Enterobacterales (*Escherichia coli, Proteus* spp. etc.) for some β-lactam antibiotics. The interpretation for amoxicillin, amoxicillin-clavulanate, first-generation cephalosporins, and cefovecin (Convenia), allow for different interpretation because of the high concentrations these drugs achieve in urine. (A urine-specific interpretation is pending for use of ceftiofur in dogs.) This interpretation assumes that (1) the infection is confined to the lower urinary tract, (2) other structures are not infected such as the prostate or kidney, and (3) the animal can sufficiently concentrate the urine (eg, no evidence of chronic kidney disease, or medications that may dilute the urine). For complicated infections that involve the deeper layers of the mucosa, the renal tissue, or the prostate tissue, the tissue concentrations observed in urine will not be achieved. In these instances, it is the tissue concentration – which is correlated to the plasma concentration – that will be predictive of a bacteriologic cure (Frimodt-Møller, 2002).

For example, the "S" breakpoint for systemic infections (eg, skin and soft-tissue) in small animals for ampicillin/amoxicillin and amoxicillin-clavulanate is ≤ 0.25 µg/mL. But when the isolate is identified from the lower urinary tract, a higher "S" breakpoint of ≤ 8 µg/mL can be used. The higher breakpoint was derived from studies showing that when these drugs are administered orally to dogs, concentrations in urine are many times higher than systemic concentrations (eg, > 300 µg/mL). The high urine concentrations produced clinical effectiveness for treating infections caused by methicillin-susceptible *Staphylococcus* spp, and Enterobacterales that would otherwise have been categorized as resistant according to the conventional (non-UTI) interpretive categories. The higher breakpoint for urine isolates also applies to use in cats for amoxicillin and amoxicillin-clavulanate (KuKanich, et al. 2021).

Higher breakpoints are also established for first-generation cephalosporins and cefovecin when interpreting urine isolate susceptibility. The cefazolin and cephalexin breakpoint of ≤ 16 µg/mL ("S") can be used to predict the susceptibility of cefazolin and

the oral first-generation cephalosporins instead of ≤ 2 µg/mL used for other tissues. A breakpoint of for cefovecin of ≤ 2 µg/mL ("S") can be used for urinary tract isolates from dogs instead of ≤ 0.5 µg/mL which applies to skin infections. Cefpodoxime, an approved oral cephalosporin for dogs, may be tested individually because some isolates may be susceptible to this agent while testing resistant to cefazolin or cephalexin.

A higher urinary breakpoint for cephalosporins offers an alternative for treatment instead of relying on fluoroquinolones and carbapenems. Higher breakpoints for first-generation cephalosporins and cefovecin are justified because of the studies that show high concentrations in urine after standard dosages, and efficacy for treating sporadic infections at these dosages. A higher breakpoint of ("S") of ≤ 16 µg/mL for first-generation cephalosporins will produce a "susceptible" test result for cephalexin for over 90% of *E. coli* and *Proteus mirabilis* isolates from dogs (Moyaert, et al, 2016). On the other hand, using a cephalexin breakpoint of ≤ 2 µg/mL would cause nearly all Enterobacterales isolates to be classified as "resistant" and would drive more use of fluoroquinolones, carbapenems and other highly active agents for treating bacteria of the Enterobacterales.

Exception for Topical Treatment: When applying topical antibiotic treatment (for example, to the surface of the skin, in the ears, or on the eye), the concentration of the administered antibiotics is many times higher than the plasma drug concentration. There are no clinical breakpoints for interpreting susceptibility for agents applied topically. Although an external ear culture can establish the presence of bacteria, susceptibility testing should not be used to predict the efficacy of topical formulations since these products reach substantially higher concentrations on the skin than systemic products and since breakpoints are established for systemic not topical formulations.

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Why Have Susceptibility Testing Breakpoints Changed for Veterinary Antibiotics?

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If accurate breakpoints are not used for susceptibility testing, it may increase the emergence of resistant bacteria because of failure to meet the optimum pharmacokinetic-pharmacodynamic (PK-PD) target. If the PK-PD target is not achieved, suboptimal exposure may lead to the selection of resistant strains that multiply and become the dominant population in an infection (Martinez, et al. 2012; Drusano, 2004).

To improve the safe and effective use of antimicrobial agents for treatment of animal bacterial infections, The Clinical and Laboratory Standards Institute (CLSI, www.CLSI.org) continually analyzes existing breakpoints and re-evaluates the accuracy based on new pharmacokinetic, clinical, or microbiologic data. This review is needed to support a revision of the antimicrobial susceptibility testing (AST) breakpoints. This was recently done for enrofloxacin, marbofloxacin, and chloramphenicol for use in dogs in the 7th Edition of VET01(S) (CLSI, 2024). There are new changes pending – a revision of these fluoroquinolone breakpoints for cats, and revision of the ampicillin breakpoints for dogs that have been proposed to the CLSI-VAST subcommittee, and if approved, will appear in the next (8th) edition of CLSI standard document VET01(S), scheduled for publication in 2026.

Because these revised susceptibility testing breakpoints are different than those used previously, laboratories should ensure that they are using the latest CLSI approved standard for interpretation. Device manufacturers (the companies that make testing plates) need to update their testing methods and software. Other groups that use susceptibility testing data for monitoring and surveillance also must be aware of these changes to avoid misinterpretation of data. Revising the breakpoints to values that more accurately reflect current understanding of PK-PD and antimicrobial resistance may improve the effective use of these antimicrobial agents and reduce the risk of selecting resistant bacterial strains. This continual review and revision of CLSI breakpoints will contribute to antimicrobial stewardship and Ambrose, et al 2020).

How are Breakpoints Developed and Revised?

More complete details on how breakpoints are developed are described in the paper by Turnidge and Paterson (2007). Clinical breakpoints for the susceptibility testing interpretive categories are developed through a rigorous process of evaluating the existing pharmacokinetic data for these antimicrobial agents – published data, or from the manufacturer – and obtaining an overall value for the population using statistical methods. An overall measure of variability – standard deviation and coefficient of variation (CV%) – is also calculated. These values are used to develop the PK-PD cutoff value. The method used to find the optimum PK-PD cutoff are Monte Carlo Simulations, which consider the population distribution for thousands of simulated animals (Ambrose, et al. 2006). The PK-PD cutoff value is then compared with the wild-type distribution, which becomes the wild-type cutoff, also known as the epidemiological cutoff value (ECOFF). The breakpoint may fall on either side of the wild-type distribution, depending on the activity of the antimicrobial agent and MIC values of the target pathogen. Occasionally the breakpoint may split the wild-type, but this is usually avoided of possible to decrease the risk of testing errors affecting the clinical outcome.

The PK-PD cutoff value is based on the PK-PD parameter for the antimicrobial agent, and the therapeutic target. Antimicrobial agents vary in the type of exposure needed for a clinical cure (Figure 1). Some drugs achieve a better cure rate with high concentrations, expressed by the area-under-the-curve – AUC. The parameter used to predict success is the AUC/MIC ratio. Other drugs are more effective when there is a long time above the MIC (T>MIC).

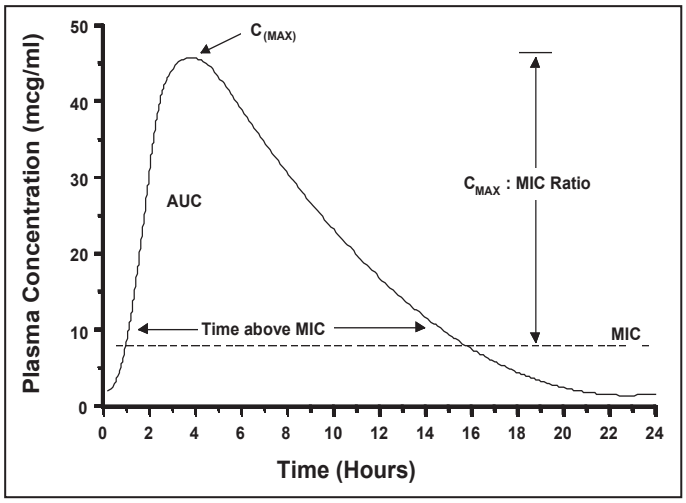

Figure 1: PK-PD concepts for antimicrobials.

Pharmacokinetic/pharmacodynamic (PK-PD) relationships consider how these factors relate to clinical outcome, how dosage regimens can be formulated that optimize the PK-PD relationships, and the proper setting of the clinical breakpoint value.

The PK-PD target varies among the antimicrobial agents. The beta-lactam antibiotics are time-dependent, (T>MIC). This includes penicillins, potentiated-aminopenicillins, cephalosporins, and carbapenems. Their clinical activity is measured by the time

(percent of a 24-hour interval) the concentration is above the MIC (T>MIC). Beta-lactam agents require longer time exposure for full inhibition of target enzymes and the concentration of these drugs should be kept above the MIC during the dosing interval – or approximately ½ the interval for most drugs.

Fluoroquinolone antimicrobials (enrofloxacin, marbofloxacin, orbifloxacin, and pradofloxacin), and the aminoglycosides (amikacin, gentamicin) are concentration-dependent. Either the peak concentration, or the area under the plasma concentration curve ratio (AUC) can predict antibacterial success, but the AUC/MIC ratio is the most common used today. For fluoroquinolones a AUC:MIC ratio greater than 72-125 has been associated with the optimum antibacterial effect. For streptococci, a AUC:MIC ratio of 30-50 may be sufficient for some infections. For aminoglycosides a AUC/MIC ratio >90 can predict clinical success. The AUC is measured for an entire 24-hour interval, regardless of the frequency of administration. For these antimicrobial agents, once-daily is usually sufficient.

Other drugs that require long exposure include tetracyclines, macrolides (erythromycin, azithromycin, tulathromycin), chloramphenicol, and clindamycin. For these agents, the drug concentrations should be maintained at the site of infection above the MIC throughout most of the dosing interval and clinical efficacy is predicted from the AUC/MIC ratio, which measures total exposure for the entire treatment interval. This relationship shows that for this group of drugs, an AUC/MIC ratio above 24 is usually associated with treatment success – meaning that the average concentration is above the MIC for a 24-hour interval.

Recent Breakpoint Revisions

The 7th edition of the CLSI VET01(S) standard includes new breakpoints that will replace old ones developed many years ago. The canine breakpoints have been published (Papich et al. 2023) and the cat breakpoint publication is pending. These changes from the prior breakpoints reflect more current understanding of the PK-PD properties of fluoroquinolones, more pharmacokinetic data, and a large database of microbiology data not available previously. These changes are shown in the table below.

This table shows the new SDD category, which requires a higher dose. These breakpoints apply to *Staphylococcus* spp., Enterobacterales (for example, *Escherichia coli, Klebsiella pneumoniae, Proteus* spp.), *Pasteurella multocida* (cats), and *Pseudomonas aeruginosa*. Note that isolates that previously may have tested S, will now be interpreted as R. This table does not show the breakpoints for *Streptococcus* spp. which are one dilution higher.

A new breakpoint was also included in the 7th edition of the VET01(S) standard for chloramphenicol. This was developed to reflect current understanding of PK-PD principles for chloramphenicol, and new data on MIC distributions. The new breakpoint for dogs is S, ≤ 2 µg/mL; I, 4 µg/mL; and R, ≥8 µg/mL. This replaces the old breakpoints of S, ≤ 8 µg/mL; I, 16 µg/mL; and R, ≥32 µg/mL. At this new breakpoint, very few isolates from dogs will test susceptible.

Interpretive Categories for Antimicrobial Agents in Dogs and Cats

	Breakpoints (µg/mL)			
	S	**I**	**SDD**	**R**
Dogs				
Enrofloxacin (Old)	≤ 0.5	1–2		≥ 4
Enrofloxacin (New)[a, b]	≤ 0.06		0.12–0.25	≥ 0.5
Levofloxacin	≤ 0.5	1		≥ 2
Marbofloxacin (Old)	≤ 1	2		≥ 4
Marbofloxacin (New)[a, b]	≤ 0.12		0.25	≥ 0.5
Pradofloxacin	≤ 0.25	0.5–1		≥ 2
Chloramphenicol (Old)	≤ 8	16		≥ 32
Chloramphenicol (New)[c]	≤ 2	4		≥ 8
Ampicillin (human)	≤ 8	16		≥ 32
Ampicillin (proposed)[d]	≤ 0.25	0.5		≥ 1
Ampicillin (proposed)[e]	≤ 2		4	≥ 8
Cats				
Enrofloxacin (Old)	≤ 0.5	1-2		≥ 4
Enrofloxacin (New) [a]	≤ 0.12	0.25		≥ 0.5
Marbofloxacin (Old)	≤ 1	2		≥ 4
Marbofloxacin (New) [a, b]	≤ 0.25	-	0.5	≥ 1
Pradofloxacin	≤ 0.25	0.5–1		≥ 2

a. Susceptible fluoroquinolone dose: 5 mg/kg once daily, enrofloxacin; 2.75 mg/kg once daily, marbofloxacin.
b. SDD fluoroquinolne dose: 10-20 mg/kg once daily, enrofloxacin; 5.5 mg/kg once daily marbofloxacin.
c. Chloramphenicol dose: 50 mg/kg, oral, q8h.
d. Ampicillin dose: 20 mg/kg IV, q8h (or ampicillin-sulbactam)
e. Ampicillin SDD dose: 100 mg/kg IV q8h.

Other breakpoints under revision, or yet to be approved by the CLSI committee are breakpoints for ampicillin (IV), orbifloxacin, and meropenem.

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Conflict of Interest / Disclosure

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TUESDAY, APRIL 29, 2025 | 11:30 AM

Clinical Investigation and Biomarker Discovery in Early Drug Development for Allergic Dermatitis
Part 1: Introduction to Biomarkers and Molecular Advancements

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What are Biomarkers?

For some time now, the term biomarker has been a buzz word in the drug development industry and literature. While the term "biomarker" began to pick up use in the 1980s, the concept dates much further back into the 1950s where "biological markers" were described and applied in medical practice. What exactly is a biomarker? In 1998, the National Institutes of Health (NIH) established a working group [Biomarkers Definitions Working Group (BDWG)] and published the definition for biomarker as "a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or responses to an exposure or intervention, including therapeutic interventions [1]." Around the same time, a joint venture on chemical safety, the International Programme on Chemical Safety led by the World Health Organization (WHO), defined biomarkers as "any substance, structure, or process that can be measured in the body or its products to predict the incidence or outcome of a disease [2]."

In veterinary medicine, biomarkers are widely used in day-day-to practice and include physiological, radiographic (i.e., imaging), histological, and molecular measurements. Physical Exam findings such as blood pressure, heart rate, body temperature, and respiratory rate are classic examples of widely used biomarkers that provide insight into a patient's physiological state and possible disease condition. Biomarkers are a subcategory of medical signs, which are detected and measured through different tests or procedures [3]. The diagnosis or staging of a variety of diseases often requires imaging biomarkers (e.g., vertebral heart score, corticomedullary ratio, etc.) which are calculated measurements taken from different imaging modalities. The grading of neoplastic tumors relies on histological biomarkers quantified from tissue samples. Molecular biomarkers from clinical laboratory tests such as complete blood counts (CBC), comprehensive chemistry panels, urinalysis, even serological titers, are not only standard in practice but critical in evaluating a patient's health status. Biomarkers are objective medical signs that modern laboratory science and technology allows us to measure with reproducibility.

This distinction between biomarkers and clinical endpoints is a nuance perhaps obvious in clinical practice, but also critical in biomedical research. Whereas biomarkers are objective and quantifiable characteristics of biological processes, they do not necessary correlate with a patient's well-being or quality of life. Clinical endpoints, however, are variables that are meant to do just that, reflect how a patient functions or survives; in human health clinical endpoints may characterize how a patient "feels" in a clinical trial [4]. Clinical endpoints, or clinical signs/symptoms, while less quantifiable, are most relevant as the goal of clinical practice is to improve the well-being of patients. After all, clinical teaching tells us to "treat the patient, not the paper."

Advances in Molecular Biology

With advances in molecular biology over that past couple of decades, we now have sophisticated technology to evaluate a variety of molecules with increasing sensitivity as well as measure or detect cellular entities or complex processes. We can extract the host genome with a simple oral swab or characterize a tumor through DNA sequencing to understand critical markers of neoplasia for prognosis and treatment recommendations. We no longer must wait days for a positive culture for a diagnosis of dermatophytosis, rather we can detect the presences of fungal DNA directly from a hair root sample using polymerase chain reaction (PCR). PCR is a laboratory technique for rapidly amplifying millions to billions of copies of a specific segment of nucleic acid (DNA or RNA) [5]. DNA detection and sequencing technology has allowed medicine to go beyond identifying the presence of a pathogenic microorganism by PCR. We can now understand the differences in the microbiome in a diseased state compared to healthy. Microbiome can briefly be defined as the characteristic microbial community occupying a reasonable well defined habitat which has distinct physio-chemical properties [6]. This molecular tool provides a way to measure, even quantify, the loss of diversity of the microbiota leading to a medical condition such as dysbiosis.

Within functional genomics, or how genes (i.e., the DNA) are actively contributing to cellular processes and responses, we find a powerful tool called transcriptomics. At a molecular level DNA is *transcribed* to a variety of types of RNA molecules, including messenger RNA (mRNA), non-coding RNA (ncRNA) such as micro RNA (miRNA), and other types of RNA. Transcriptomics both profiles and quantifies the *expression* of genes, aiming to understand the identity, abundance, structure, and regulation of RNA molecules with relationship to disease phenotype or mechanism. RNA sequencing (RNA-seq) is a widely used technique in transcriptomics that allows for the high-throughput sequencing of RNA molecules, providing bulk (and precise) information 2 about the types and quantities of RNA transcripts present in a biological sample.

Differential expression analysis enables the comparison of gene expression between different conditions, such as healthy vs. diseased tissues or treated vs. untreated cells

identifying genes that are upregulated or downregulated under specific conditions [7]. Recent advancements in transcriptomics have allowed for the study of gene expression at the single-cell level. In contrast with bulk sequencing described above, single-cell RNA sequencing (scRNA-seq) allows for the exploration of minute changes within single cells. Next, spatial transcriptomics enables researchers to map the gene activity of individual cells within a single sample, maintaining the spatial context of the cell populations and allowing for contextual analysis of tissue architecture [8]. From a biomarker perspective, the ability to identify and quantify RNA has been paramount in global health; case in point, COVID-19 tests with the capability to diagnose patients with active viral infections. Nucleic acid amplification tests (NAAT) rely on the amplification of existing genetic material in a sample; in the case of a patient with SARS-CoV-2, the virus's genomic material is RNA and is present in the body only while the virus is still replicating. From a nasopharyngeal swab to the laboratory, NAATs include the PCR assay to amplify viral genomic material for detection and can provide results in hours to days.

Of note is another novel cellular entity breaking into the biomarker scene, the extracellular vesicle (EV). This tiny cargo is in fact packed with a multitude of potential molecules that may serve as biomarkers such as proteins, metabolites, lipids and nucleic acids. EVs are secreted (i.e., actively released) from the cell membrane as means of intracellular communication and by nature can be found circulating throughout the body, making EVs prime candidates for sampling molecular signatures of tissue not easily accessible without invasive procedures. Further technological advancements allow us to enrich or concentrate targeted samples of EVs for robust analysis of the cargo itself [10]. Discovery technology for the large-scale study of proteins (proteomics), metabolites (metabolomics), and cellular lipids (lipidomics) is “supercharging” biomarker discovery [11]. Because it is now feasible to interrogate and integrate the complex molecular makeup of diseases more broadly using multiomics (a discipline that combines data from the multiple “omics” discussed here), while avoiding a targeted, often biased look at specific molecules analyte-by-analyte, scientists can gain deeper insights into complex mechanisms and their biomarker signatures at accelerated rates. Once a biomarker or set of biomarkers are identified, fit-for-purpose assays, such as ligand binding assays and immunoassays, are used to quantify these targeted protein biomarkers.

The BEST Glossary

In 2016, an FDA-NIH Joint Leadership Council published the **B**iomarkers, **E**ndpoint**S**, and other **T**ools (BEST) Resource to promote consistent use of biomarker terms and concepts, align expectations, and improve scientific understanding of study endpoints and biomarkers. The BEST glossary is a “living” resource that is periodically updated with additional terms and clarifying information aiming to capture distinctions between biomarkers and clinical assessments. As of 2024, the BEST glossary classifies biomarkers into eight specific categories: (i) Diagnostic Biomarker, (ii) Monitoring

Biomarker, (iii) Response Biomarker, (iv) Predictive Biomarker, (v) Prognostic Biomarker, (vi) Reasonably Likely Surrogate Endpoint, (vii) Safety Biomarker, (viii) Susceptibility/Risk Biomarker [12]. The BEST glossary not only defines each category of biomarkers but references specific examples as well as includes information to help differentiate some of the nuances. In practical purposes, the BEST definitions are the application of biomarkers in everyday use. I've included a summary of the current 2024 definitions with some helpful distinguishing characteristics.

1. A **Diagnostic Biomarker** is a biomarker used to detect or confirm presence of a disease or condition of interest or to identify individuals with a subtype of the disease. Diagnostic biomarkers are used for the critical determination of whether a patient has a particular medical condition; with an accurate diagnosis of a disease or condition a specific treatment may be indicated.

2. A **Monitoring Biomarker** is a biomarker measured repeatedly for assessing status of a disease or medical condition or for evidence of exposure to (or effect of) a medical product or an environmental agent. As it is measured and evaluated serially over time, a monitoring biomarker is often used to assess disease progression, including the occurrence of new disease effects, worsening of previously existing abnormalities, or change in disease severity or specific abnormalities. Monitoring biomarkers are also used in medical product development, for example they are used in therapeutic or prevention trials of new drugs or vaccines (biologics). Changes in biomarker measurements during or after treatment may provide supporting evidence of a pharmacodynamic effect or an early therapeutic response (see the next example, response biomarker). Additionally, a safety biomarker (discussed later) that is measured repeatedly in pre-clinical trials is a type of monitoring biomarker for organ toxicity.

3. A **Response Biomarker** is a biomarker used to show that a biological response, potentially beneficial or harmful, has occurred in an individual (or animal) exposed to a medical product or an environmental agent. A response biomarker can be further divided into Pharmacodynamic biomarker and Surrogate endpoint biomarker and depends on its specific "context or use" (a statement that fully and clearly describes the way the medical product development tool is to be used and the regulated product development and review-related purpose of the use).

4. A **Predictive Biomarker** is a biomarker used to identify individuals who are more likely than similar individuals without the biomarker to experience a favorable or unfavorable effect from exposure to a medical product or an environmental agent. Predictive biomarkers are often used in clinical trials (especially in human health) to select patients for participation or to stratify patients into biomarker groups (positive or negative) with the primary endpoint being the effect in the biomarker

positive group. In veterinary medicine, a predictive biomarker more commonly is used to inform patient care decisions, such as determining whether a particular patient might benefit from a specific treatment or selecting among multiple interventions.

5. A **Prognostic Biomarker** is a biomarker used to identify likelihood of a clinical event (such as death), disease recurrence or progression in patients who have the disease or medical condition of interest. In the clinical context, prognostic biomarkers are measured at a defined baseline. The term prognostic has not been used consistently in the biomedical community. Some have applied the term only in the clinical context of individuals who have already been diagnosed with a disease whereas others would include prognostic biomarkers that indicate the likelihood of a future diagnosis or disease for apparently healthy individuals. The BEST glossary makes a distinction between prognostic biomarker and susceptibility/risk biomarker, with the latter applying to individuals *without* clinically apparent disease (described later).

6. A **Reasonably Likely Surrogate Endpoint** is an endpoint supported by strong mechanistic and/or epidemiologic rationale such that an effect on the surrogate endpoint is expected to be correlated with an endpoint intended to assess clinical benefit in clinical trials, but without sufficient clinical data to show that it is a validated surrogate endpoint. Such endpoints may be used for accelerated approval for drugs and potentially also for approval or clearance of medical devices. In the case of accelerated approval for drugs, post marketing confirmatory trials have been required to verify and describe the anticipated effect on the irreversible morbidity or mortality or other clinical benefit [21 CFR 314.510].

7. A **Safety Biomarker** is a biomarker measured before or after an exposure to a medical product or an environmental agent to indicate the likelihood, presence, or extent of toxicity as an adverse effect. Common to all safety biomarkers is the ability to detect or predict these adverse drug or exposure effects.

8. A **Susceptibility/Risk Biomarker** is a biomarker that indicates the potential for developing a disease or medical condition in an individual who does not currently have clinically apparent disease or the medical condition. This contrasts with prognostic biomarkers, which indicate an increased likelihood of a specific clinical event in an individual already diagnosed with a disease or medical condition, and diagnostic biomarkers, which may confirm whether a disease is actually present.

In 2020, a chapter with Contents of a Biomarker Description was added to the BEST glossary to succinctly summarize key aspects necessary for universal “biomarker description” [13]. The following summary should be included in biomarker description.

First, the **biomarker identity**, which includes the name of the specific analyte, anatomic feature, or physiological characteristic as well as any unique identifiers or commonly used acronyms, the specific source (e.g., urine, liver, biopsy, etc.), and the type of biomarker (e.g., physiological, molecular, histological, etc.). Next, the **biologic plausibility**, or a brief summary of the biological, physiological, or pathological pathway for the association of the biomarker with the disease or condition of interest so there is a contextual linkage between the biomarker and its intended use. Last, the brief **measurement method** that will be used to measure, image, or otherwise quantify the biomarker; this includes sufficient detail to interpret results, like the units.

Clinical Utility & Application

An excellent example of a disease in veterinary medicine in which biomarkers are not only critical, but mainstay, is renal disease. It has long been accepted that the evaluation of changes in serum creatinine levels can be used as a surrogate for glomerular filtration rate. However, serum creatinine alone is not specific enough and veterinarians use a combination of biomarkers in the serum (e.g., BUN, SDMA, phosphorus, potassium, sodium, total protein, etc.), whole blood (HCT), and urine (e.g., USG, urine: protein creatine ratio, microalbumin, etc.), as well as physiological biomarkers (e.g., blood pressure, hydration measurements such as skin tent, muscle condition score, etc.) and imaging biomarkers to assess the state of renal function in a patient. Using a combination of multiple biomarkers from multiple modalities, known as a biomarker signature, provides a more accurate diagnosis than using a single biomarker alone. The International Renal Interest Society (IRIS) offers a detailed guide on how to use biomarker signatures to **diagnose** chronic kidney disease (CKD), followed by staging CKD using **monitoring** biomarkers [14]. This establishes a baseline to track disease progression as well as provides treatment recommendations, for which additional **monitoring** biomarkers are used for **response** to treatments such as blood pressure medication or phosphate binders. **Prognostic** biomarkers for substaging hypertension and/or proteinuria offer informative disease status on the anticipated progression rate of disease allowing for tailored patient management. The RenalTech® tool, newly developed by Mars Petcare, uses artificial intelligence to analyze pet medical records (mainly serially collected laboratory results) to predict whether a cat will develop chronic kidney disease (CKD) up to two years before traditional clinical diagnosis in presumptively an asymptomatic (non-clinical) patient. This is an exciting novel example of a **susceptibility/risk** biomarker in veterinary use.

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TUESDAY, APRIL 29, 2025 | 2:00 PM

Clinical Investigation and Biomarker Discovery in Early Drug Development for Allergic Dermatitis
Part 2: Biomarkers and Translational Biology in Allergic Dermatitis

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This is a two-part lecture series looking at clinical investigation and biomarker discovery from a drug development perspective. In part one, we focused on biomarker terminology and introduced the FDA-NIH BEST glossary of biomarkers used in human health. Part two focuses on the biomarker molecules specifically investigated in allergic dermatitis as well as the techniques involved in sampling. Using a biomarker lens within a comparative medicine approach, we review a handful of promising molecules. Human health has moved to integrating biomarker research into the management of allergic dermatitis, with the goal of more precise, effective, and personalized treatments [1-2]. Human atopic dermatitis (hAD) is a complex disease with multiple clinical phenotypes (i.e., endotypes), making treatment challenging. By leveraging the robust molecular learnings from human health and comparing similarities and differences across the multiple species in veterinary medicine, we can more precisely apply biomarker discovery for advancements in animal health.

Clinical sampling techniques

It is not surprising that the prominent sites for assessing biomarkers in patients with allergic dermatitis are either the blood or the skin. While sampling the blood is routine for a variety of diseases and easy to collect, it may not be the primary site of pathophysiology and therefore detecting levels of relevant soluble biomarkers or phenotyping the cells in circulation may not be a feasible source to understand disease. As an example, human peripheral blood-derived mast cells (PBdMC) were thoroughly investigated experimentally (i.e., in ex vivo cultures) from peanut allergic and non-allergic subjects using stimulus and profiled for surface receptor expression, histamine release, secretion of cytokines/chemokines, and changes in micro RNA (miRNA); among the 893 parameters investigated only IL-31 expression was differently expressed [3]. Even if collected from the same patient, the transcriptomic signature (RNA sequencing) of a clinical blood sample will not be the same as that of a lesioned skin punch biopsy sample, because the bulk gene expression of circulating white blood cells is inherently unique

compared to that of the dermis, which includes resident immune cells, keratinocytes, fibroblasts, etc. Molecular analyses of skin biopsies have shed light on the immune milieu

at the site of disease, captured alterations in the skin barrier, and likely more accurately reflect disease severity and treatment effects. Furthermore, changes in the blood are likely lagging temporally compared to changes in the skin, however if detected in the blood, may represents overall skin involvement better than a focused-localized skin biopsy [1].

While skin biopsies are highly informative and routine for diagnostic pathology, they can cause discomfort and complications, and in veterinary medicine often require sedation for collection, making them impractical for large-scale trials, longitudinal studies, and research. Minimally invasive methods have been implored to capture the molecular profile of lesional and nonlesional skin. Skin tape strips and other micro-biopsy tools are commonly utilized in human dermatology research as minimally invasive techniques for collecting epidermal samples as an alternative to skin biopsies. In the research setting, these minimally invasive techniques are useful for analyzing protein, RNA, lipid, and microbial expression [4,5,6]. RNA sequencing (RNAseq) of skin tape strips was both able to distinguish between human atopic dermatitis (hAD) and psoriasis (Pso) as well as correlate with clinical severity [4]. Unique expression signatures were identified from skin tape strips distinguishing allergic contact dermatitis from irritant contact dermatitis, two human diseases with similar phenotypic lesion types [7]. Additionally, new molecular markers from skin tape strips showed promising results for the identification of hand eczema subtypes [8]. Unfortunately, no standardized protocol for the collection and processing of tape strips currently exists.

Biomarkers in allergic dermatitis

The ideal biomarker is biologically relevant and linked to disease mechanisms. Unfortunately, it is not as simple as targeting a molecule for treatment and measuring that same molecule directly as a biomarker. Interleukin (IL)- 31, the well-known itch cytokine, is an excellent example of this. Despite both the success of lokivetmab, a caninized monoclonal antibody against IL-31, in treating dogs with allergic dermatitis and evidence of increased gene expression levels of IL-31 in lesioned skin, IL-31 has not yet shown promise as a standalone biomarker, showing only moderate correlation of disease severity in canine atopic dermatitis (cAD) using the pruritus visual analog scale [9-12]. In feline patients with either cutaneous (allergic dermatitis) or respiratory (asthma) presentations of feline atopic syndrome (FAS), IL-31 was identified as the most consistently elevated cytokine in circulation when compared to healthy controls, but these elevations are moderate at best using an ultrasensitive assay, and not always detectable in diseased patients [13]. IL-31 gene expression was found to be differentially expressed in skin punch samples from horses with insect bite hypersensitivity (IBH), but only in mild to moderate/severe cases; IL-31 receptor A (IL-31Ra), a cell bound receptor for the soluble IL-31 ligand however, was one of the top differentially expressed genes correlating with IBH severity [14]. As seen in veterinary medicine, more evidence has accumulated that the itch cytokine (IL-31) lacks a strong disease severity correlation in

hAD as well [1]. With advances in technology allowing for unbiased, deeper molecular characterization of disease, both novel therapeutic targets and clinically applicable biomarkers can emerge.

Many of the potential biomarkers assessed are familiar cytokines, chemokines, and skin barrier molecules that play key roles in the interactions of keratinocytes with either the nervous system and/or immune cell populations. Renert-Yuval et al. reviewed evidence using the GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) approach, evaluating the strength of data for each potential biomarker across the spectrum of pediatric and adult cases, both at baseline and during topical and systemic treatments [1]. The molecule with the greatest evidence as a biomarker in hAD is thymus and activation-regulated chemokine (TARC), also known as CCL17; TARC has strong correlation with hAD clinical severity at baseline and during therapy [1, 15-18]. TARC is a chemokine primarily associated with attracting Th2 cells and is believed to play a significant role in allergic diseases like atopic dermatitis and asthma by recruiting immune cells to the site of inflammation by binding to the CCR4 receptor on these cells to signal their migration. TARC concentrations have been evaluated as a potential biomarker in canine AD; in one study serum TARC concentrations were significantly (>10-fold) higher in dogs with canine AD as compared to healthy controls [19]. TARC has been evaluated as a monitoring biomarker for response to JAK inhibitors in both human and canine AD with promising results [19,20]. Several studies have shown that TARC may be increased in serum and/or tissues in various human eosinophilic conditions [21], hinting to TARC as a potential biomarker to evaluate in feline disease with eosinophilic granuloma complexes. In a small study, transcriptomics from biopsies of eosinophilic plaques from four cats with feline atopic skin syndrome (FASS) showed upregulation of Th2 cytokines, as well as TARC, when compared to healthy tissue control samples [22]. In horses with IBH however, TARC was not significantly differentially expressed in lesion samples compared to healthy horse skin, however other Th2 cytokines and chemokines were [14].

Summarized and categorized here are other biomarkers from hAD with the strongest evidence for correlation with disease severity and thus clinical potential as monitoring biomarkers (i) General Inflammation Markers: Serum lactate dehydrogenase (LDH) and C-reactive protein (CRP), (ii) Allergy-Related Markers: peripheral eosinophil counts, (iii) Th2-Related Cytokines and Chemokines: IL-13, CCL26/eosinophil-attracting chemokine (eotaxin-3), CCL27/cutaneous T-cell–attracting chemokine (CTACK), CCL18/pulmonary and activation-regulated chemokine (PARC), and CCL22/macrophage-derived chemokine (MDC), and (iv) Th22-Related Cytokines: IL-22 [1]. Notably, periostin and IgE failed to demonstrate strong correlative evidence as a biomarker for disease severity [1], but periostin may be useful for monitoring treatment effects [2]. While not specific, peripheral eosinophilia from complete blood counts (CBC) has been used as a

supportive finding in diagnosing allergic disease in cats and horses and may be useful in monitoring novel treatment responses over time [14,23,24,38].

Some biomarkers, such as nitric oxide synthase 2 (NOS2), matrix metallopeptidases 8 and 9 (MMP8/9), human beta-defensin 2 (hBD2), and CTACK, have shown promise in differentiating hAD from Pso [2,15,25]. Others may distinguish between endotypes of hAD, but research is still in its early stages [26]. Continued molecular characterization and correlation to clinical disease attributes across different species are critical first steps in identifying novel biomarkers. Compared to human health, limited studies exist characterizing the molecular disease phenotypes of canine, feline, and equine allergic dermatitis. However, the few recent studies published begin to paint a familiar picture: one of prominent Th2 signatures (e.g., IL-4, IL-5, IL-13, etc.) while highlighting distinct differences for each of the veterinary species [13-14, 27-28]. For example, horses with IBH showed differential expression in IFN-γ-inducing protein (IP-10) and IL-10, as well as eotaxin-3. However, chemokines CXCL9 and monocyte chemoattractant protein-1 (MCP-1) had the highest sensitivity for IBH in general [14]. Eosinophilic plaques from FASS cats had increased Th2 cytokines, as mentioned, but also Th17 signatures (e.g., S100A8 and IL-17A), as well as the IP-10 [22]. Detailed molecular characterization of the similarities or differences seen in lesions from the four distinct cutaneous reaction patterns in FASS is warranted to understand whether there are molecular endotypes in play [29]. Single-cell sequencing (scRNAseq) is a cutting-edge technology that examines the nucleic acid sequence information from individual cells, offering a high-resolution view of cellular differences and functions. This may provide unprecedented insights into the cellular landscape of the skin, paving the way for more accurate diagnoses and effective treatments.

Loss-of-function variants in the filaggrin gene are significant predisposing factors for developing hAD, serving as susceptibility/risk biomarkers. Additionally, filaggrin gene mutations may have prognostic value, as they correlate with the severity and early onset of persistent hAD into adulthood [1,2,15]. With a prognostic biomarker, the risk of disease progression or recurrence, regardless of prior treatments, could be assessed for a given patient. Filaggrin type proteins are crucial for epidermal barrier integrity; genetic variants in filaggrin affect the terminal differentiation of keratinocytes and therefore impair the epithelial barrier, making it more permeable for different allergens. Quite a few studies have been published on filaggrin in dogs and its potential relevance to AD [30-34]. Very limited knowledge of the skin barrier in feline patients exists. To date, no study has reported on potential filaggrin and lipid abnormalities in the skin of allergic cats [35]. In horses with insect bite hypersensitivity (IBH), however, analysis of lesional skin revealed a significant downregulation of genes related to tight junction formation in the skin, but no differential expression in keratinocyte terminal differentiation proteins like filaggrin [36]. Horses with allergic dermatitis have an altered phospholipid profile in their sera

compared to healthy horses, and these profiles seem to change according to their clinical status. Sphingomyelin appears to have an active role during equine IBH disease [37].

Micro RNA (miRNA) and microbiome

Emerging in the biomarker field with feasibility across a multitude of diseases are micro RNAs (miRNAs). These tiny hairpin RNA molecules serve as master regulators of messenger RNA (mRNA), which is what we typically think of when discussing gene expression or transcriptomics. A single miRNA can control multiple mRNAs within the same pathway, shuttling transcripts for destruction before a protein is made. Dysregulated miRNA expression can alter cellular responses and contribute to, or even drive, various diseases. Several miRNAs have been found to be implicated in the crosstalk between inflammatory cells and keratinocytes in human patients affected by atopic dermatitis; miR-155 is one of the most significantly upregulated miRNAs in the lesional skin of patients affected by hAD [39, 40]. However, just like cytokines and chemokines, it is unlikely that one miRNA alone holds the key to explaining the pathology of asthma or allergic diseases. Mechanistic insight into the roles of miRNAs going forward will be critical [41, 42]. It is feasible that miRNA profiles could be used as biomarkers, as they are easily detectable in body fluids. An increased expression of miR-142, miR-146a, miR-155, and miR-21 was detected in the lesional skin of Labrador and Golden Retrievers with allergic dermatitis compared to healthy controls. However, this expression was not specific to allergic inflammation, as both allergic and nonallergic inflammation showed similar expression patterns [43]. Further work is needed to understand miRNA signatures to predict disease phenotypes.

There is increasing emphasis on the importance of the role of the cutaneous microbiome in managing allergic dermatitis [35]. From a mechanistic perspective, shifts in the microbiome diversity (or dysbiosis) in atopic dermatitis is thought to contribute to impaired skin barrier function and immune cell dysfunction. It is believed that both the cutaneous and the gut microbiota can influence the pathogenesis of atopic diseases [44, 45]. More specifically, the role of Staphylococcus species have been evaluated in the context of allergic dermatitis in people as well as dogs [45-47]. *Staphylococcus aureus,* the most commonly identified bacteria associated with hAD, is often found in increased abundance on the skin of affected individuals, and utility as a severity biomarker has been studied [1,2]. Similar to hAD, the most common finding in cAD is a decrease in bacterial diversity (dysbiosis) on the skin, but in favor of *Staphylococcus pseudintermedius* (not *S. aureus*) [48]. The measurement of *S. aureus* on the skin shows great promise as a clinically important biomarker for atopic eczema in human health, but prospective clinical trials and large longitudinal registries that include skin microbiome testing are still needed [49]. Investigations into the cutaneous microbiome, including the role of other microorganisms such as yeast, are under way in our veterinary species [50]; these are the first critical steps in identifying the utility of the microbiome as a biomarker for allergic dermatitis. Recently, exploration into the gut-skin axis was explored by

assessing the bacterial diversity and composition of the gut microbiome in dogs with atopic dermatitis. Analysis of stool microbiota from four atopic and three healthy dogs revealed a clear difference in gut microbiota alpha diversity. Alpha diversity measures the

richness and evenness of microbial species within a single sample; higher alpha diversity generally indicates a more robust and resilient ecosystem, while lower alpha diversity can be a sign of dysbiosis or imbalance [51]. In the same study, treatment with oclacitinib (30-day course) was not associated with changes in the gut microbiota but other treatment modalities may yet have an impact.

Where to next?

The stringency of experimental proof required for biomarker validation depends on its position between a research tool and a clinical endpoint. In human health, the discovery of a novel, validated disease-related biomarker is demanding and requires multiple steps, from the first detection of the potential tissue-derived factor to the final confirmation and acceptance by regulatory organizations. In contrast, veterinary medicine lacks a formal regulatory process for biomarker approval, relying instead on key opinion leaders, robust publications, and industry to drive clinical utility and acceptance. This path, however, is hardly less laborious. It is important to note that at this stage, despite robust research evidence, none of the candidate biomarkers in hAD have reached validation, and no single biomarker is routinely used in the clinical setting. Research, however, on endotypic biomarkers is ongoing to fine-tune the identification and stratification of human patients with AD. In the pursuit of breakthrough treatments for our veterinary patients, especially those without options other than steroids, exploration of biomarkers and their clinical application across the spectrum of allergy and dermatological diseases in the drug development pipeline might just be the key [38]. Collaborations between academic consortia, clinical entities, and commercial organizations will be essential for the success of such endeavors.

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TUESDAY, APRIL 29, 2025 | 3:00 PM

Defining the Genomic Landscape of Canine Cancers

CHERYL LONDON, DVM, PHD, ACVIM(O) PROFESSOR

Description

In this session, new methodologies being used to characterize canine cancers at the genomic level will be reviewed including various sequencing techniques, the role of liquid biopsy as a non-invasive diagnostic and monitoring tool, and currently available diagnostic platforms. The application of this knowledge to more effectively treat canine cancers with targeted therapies will be discussed.

Learning Objectives

1. Understand the advancements in methods and tools being used to define the genetic drivers of canine cancer.
2. Understand the principles of liquid biopsy and its utility for cancer screening and monitoring.
3. Understand how information derived from genomic analysis of canine cancers can be used to facilitate application of targeted therapies.

TUESDAY, APRIL 29, 2025 | 4:30 PM

Advances in the Diagnosis and Treatment of Canine Cutaneous T Cell Lymphoma

CHERYL LONDON, DVM, PHD, ACVIM(O) PROFESSOR

Description

In this session, recent findings regarding the genomic landscape of canine CTCL will be reviewed, including a comparative analysis with human CTCL. Novel therapeutic approaches including the application of targeted therapies and immunotherapy will also be discussed.

Learning Objectives

1. Understand the similarities and differences between canine and human CTCL.
2. Understand the recent findings regarding genomic drivers associated with canine CTCL.
3. Understand how various targeted therapies can be combined with immunotherapy to treat canine CTCL.

TUESDAY, APRIL 29, 2025 | 9:00 AM

Malassezia REVIEW Parts i and ii: Clinical signs, Diagnosis, therapy and resistance

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Introduction

The genus *Malassezia* is comprised of a group of lipophilic yeasts that have evolved as skin commensals and opportunistic cutaneous pathogens in a variety of mammals and birds. *Malassezia* yeasts were recognised on the context on canine otitis externa in the 1950's but it is likely that *Malassezia* dermatitis in dogs was first discussed at an AAVD/NAVDF meeting in Arizona in 1987, when Ken Mason presented an abstract describing 3 canine cases. This tends to support the (flawed and discredited) notion that "there are no new diseases, just newly recognised ones". A gradual process of acceptance of the relevance of this yeast followed and *Malassezia* dermatitis is now part of the daily practice of small animal veterinarians globally.

Diseases associated with *Malassezia* yeasts

The transition from commensal to pathogen is frequent in dogs in particular, and in cats to a lesser extent, such that cases of *Malassezia* otitis externa and *Malassezia* dermatitis are commonly presented to veterinarians in small animal practice. For example, the prevalence of otitis externa amongst dogs presenting to primary care practices is around 10 per cent [1], and up to 70 per cent of such cases may be associated with *M. pachydermatis*. These cases are seldom straightforward to manage,because clinical disease often reflects yeast proliferation due to a disturbance in the normal homeostatic balance of host immunity, on the one hand, and yeast virulence, on the other. Thus, successful case management is often dependent upon both treating yeast (and any concurrent bacterial) overgrowth with topical or systemic antimicrobial treatments, as well as identifying and correcting where possible, predisposing factors. Commonly identified factors include concurrent allergic or endocrine skin disease, defects in cornification, or anatomical defects such as skin folds or stenosed ear canals [2].

Whilst the general principles discussed above are equally applicable to cats, there are some notable differences in certain biological aspects. In comparison to dogs, where it is unusual to isolate in culture a *Malassezia* spp. yeast other than *M. pachydermatis*, an array of strictly lipophilic species has been reported in cultural studies (with molecular confirmation of colony identification) of feline skin. These include *M. sympodialis*, *M. globosa*, *M. furfur*, *M. nana* (especially ear canal) and *M. slooffiae* (especially claw fold).

Amongst the underlying diseases known to favour *Malassezia* dermatitis in cats, in addition to the common allergic and anatomical (fold) triggers, syndromes involving visceral neoplasia and other metabolic diseases may be identified (including pancreatic paraneoplastic alopecia, exfoliative dermatitis with thymoma, superficial necroltyic dermatitis).

Beyond dogs and cats, *Malassezia* overgrowth in the intermammary region and preputial fossa has been implicated in tail-head pruritus and localised dermatitis in horses. Goats may present with *Malassezia*-associated seborrheic dermatitis. *Malassezia* otitis has been reported in fennec foxes, ferrets, pigs and camels.

Pathogenesis

Fungi are nutritionally absorptive organisms and therefore *Malassezia* liberate an extensive array of enzymes into their environment to create substrates suitable for entry into the cell and subsequent metabolism. These enzymes, especially in the context of marked yeast proliferation, have the potential to damage host epidermal cells and to activate the host's innate and specific immune systems. A range of immunological hyper-responsiveness has been observed in dogs (none, immediate, delayed, contact); publications addressing these aspects in cats are awaited with interest.

Treatment of *Malassezia* dermatitis in dogs and cats.

Recently, the World Association of Veterinary Dermatology commissioned the development of clinical consensus guidelines for the diagnosis and treatment of *Malassezia* dermatitis in dogs and cats [3]. The final version comprised a systematic review of published therapeutic studies, and current information on the ecology, pathophysiology, diagnosis, and prevention of skin diseases associated with *Malassezia* yeasts in dogs and cats. That review is freely available online, both as a full text version[3] and a short summary[4].

At the time of preparation of the Consensus Guidelines, amongst the various treatments utilised for *Malassezia* dermatitis in dogs, strong evidence was available only for the use of a 2% miconazole and 2% chlorhexidine shampoo, used twice weekly [3]. This may be considered to be the topical treatment of first choice, where available and locally approved, and when owners are able to apply the product effectively. Moderate evidence is available for a 3% chlorhexidine shampoo.

For canine *Malassezia* dermatitis, there is moderate evidence for the oral use of ketoconazole at 5-10 mg/kg once or twice daily; and oral itraconazole at 5mg/kg once daily or two consecutive days per week. Based on current limited evidence, the use of either of these two azoles is justified in canine cases, and the final choice may depend on geographical differences in availability, regulatory status, and cost. Rationale for itraconazole instead of ketoconazole includes a perceived tendency for itraconazole to be better-tolerated, and the potential for intermittent dosing. However, cost factors makes ketoconazole a more practical choice in some countries, and definitive statistical evidence of superior safety and/or efficacy is lacking. Compounded formulations must be

avoided due to unreliable bioavailability. Evidence for oral fluconazole was provided by a study where it was used at 5-10 mg/kg once daily conjunction with cephalexin, but more recently fluconazole at dose of both 5mg/kg and 10mg/kg were reportedly as effective as itraconazole at 5 mg/kg SID. Unfortunately, yeast population in this study were assessed by cytology and not quantitative culture. MIC values *in vitro* for fluconazole are routinely the highest amongst antifungal azoles utilised in veterinary medicine; this may correlate with intermittent anecdotal reports of treatment failures. Oral terbinafine warrants further evaluation due to partial beneficial effects in two trials and questionable stratum corneum concentrations in a pharmacokinetic study when given at the current dose of 30 mg/kg once daily.

In cats, there is weak evidence only for the use of oral itraconazole at doses of 5-10 mg/kg daily; or 5 mg/kg on a 7 days on / 7 days off protocol. In view of this limited data, good safety profile, and in line with clinical consensus guidelines for feline dermatophytosis, itraconazole should be considered as the systemic azole of first choice in this species for *Malassezia* dermatitis. Topical chlorhexidine and azole products have not been evaluated although their use is intuitive as adjunctive or sole treatments where application is practicable and clinically appropriate, such as in localised infections.

Concerns about drug resistance (see below) are driving efforts to identify efficacious treatments beyond the conventional antifungal drugs. A silver nanoparticle shampoo showed promise in an open nonrandomised study. There are reports of *in vitro* efficacy against *M. pachydermatis* of a honey-based gel, monensin and, to a lesser extent, narasin (polyether ionophores originally marketed as anti-coccidials and growth-promoting modifiers of the bovine rumen flora). Multiple recent publications have explored the potential antifungal utility of essential oils, complex mixtures of highly concentrated aromatic oils (primarily terpenes and/or phenylpropanoids) extracted from plants by steam distillation, hydrodiffusion or pressure. Most of the investigations have been conducted *in vitro* and their utility in clinical practice remains largely untested. Comparisons between studies are hampered by an absence of agreed standard testing methods that are not yet optimised, arbitrary assignment of interpretative criteria, and likely batch variation in activities of essential oils prepared by different methods[5].

Treatment of chronic relapsing cases of *Malassezia* dermatitis in dogs and cats can be frustrating and may be limited by financial considerations. Identification and treatment of underlying causes is an essential part of the case management.

Antifungal susceptibility and resistance in *M. pachydermatis*

There are increasing reports of the development of resistance to antifungal drugs, primarily described with regard to the 'azole' class of antifungals, which are used routinely, and globally, in the treatment of canine *Malassezia* infections. Unfortunately, surveillance for antifungal drug resistance lags behind that done for bacterial pathogens; this is in part due to a lack of standardised laboratory assays and infrequent submissions of samples for culture and susceptibility testing.

Recent publications support previous observations that most wild-type *Malassezia* spp. remain susceptible to the commonly-used azole drugs such as itraconazole, ketoconazole and miconazole, although efficacy of fluconazole is more variable (reviewed by [6]). In view of routine susceptibility and an absence of standard methods appropriate for the *Malassezia* genus, diagnostic testing in veterinary practice tends to rely upon cytological rather than cultural methods. However, laboratory studies of *M. pachydermatis* have previously demonstrated that it is possible to select for resistance to terbinafine and azoles. Of greater concern are recent sporadic reports of therapeutic failure with azoles in canine *M. pachydermatis*-associated dermatitis that were associated with increased azole tolerance *in vitro*; this might reflect the chronic and relapsing course of *Malassezia* dermatitis and otitis that often necessitate frequent and lengthy treatment courses.

Azoles and allylamines are likely the most commonly used antifungal drugs in veterinary practice. Both of these classes target the ergosterol synthesis pathway since this sterol is a major component of the cell membrane in many pathogenic fungi, whereas host mammalian cells primarily utilize cholesterol. Azole drugs inhibit lanosterol 14 –alpha-demethylase whereas allylamines such as terbinafine target squalene epoxidase.

Kano *et al*. showed that an isolate of *M. pachydermatis* with MICs of itraconazole and ketoconazole of >32 mg/L by Etest had mis-sense mutations in the *ERG11* gene that encodes lanosterol 14 –alpha-demethylase [7]. Mutations in the same gene were described in field isolates with tolerance to ravuconazole [8] and in miconazole-resistant clones of CBS1879 (the neotype culture of *M. pachydermatis*) selected by serial passage on miconazole supplemented media [9]. Angileri *et al*. isolated *M. pachydermatis* from an azole-unresponsive toy poodle that had MICs that were several fold higher when compared with strains from untreated dogs [10]. Azole resistance in *M. pachydermatis* has also been associated with quadruplication of the *ERG11* gene [11]. More recently, Kano and Murayama developed a PCR method based on primers designed to amplify 'hotspot' regions of the *ERG11* gene in *M. pachydermatis*; presence of single nucleotide polymorphisms at nucleotides 904 and 905 correlated with azole resistance [12].

Mutations in drug efflux pumps are a common mechanism of azole resistance in *Candida* species [13], and these have recently been reported in the genus *Malassezia*. Both genomic multiplication and increased drug efflux were reportedly associated with ketoconazole resistance in *M. restricta* isolated from humans [14]. Upregulation of the *PDR10* transporter gene was associated with reduced azole susceptibility in *M. furfur* [15].

A notable feature of the canine case reports is that treatment failure and resistant strains appeared to develop after months or years of therapy, suggesting that resistance is an acquired (rather than intrinsic) slowly-developing phenomenon [16].

Malassezia yeasts possess a thick cell wall with characteristic inner spiraling when viewed by electron microscopy. The hydrophobicity of the cell surface promotes adhesion and favours biofilm formation; yeast cells become embedded in an extracellular polysaccharide matrix that may protect them from antifungal drugs. The significance of

these *in vitro* observations to clinical cases of canine otitis and dermatitis requires further assessment [16].

Conclusions

Over the last 35 years, there has been a remarkable expansion of knowledge of *Malassezia* related skin diseases in dogs and cats. Most practitioners are comfortable in recognizing the varied clinical presentations and in observing the yeasts in cytological presentations. The essential need to evaluate for, and correct where possible, predisposing factors and underlying diseases is well-understood.

The emergence of azole resistance amongst *Malassezia* species warrants careful surveillance and product stewardship to ensure ongoing utility of this important drug class. Development of standard antifungal susceptibility tests appropriate for use by commercial and clinical microbiology laboratories is critical. Further data are urgently required to establish whether topical therapies are preferable to systemic treatments in this context, and to guide antimicrobial stewardship policies for antifungal therapy in small animal practice.

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TUESDAY, APRIL 29, 2025 | 3:00 PM

Sporotrichosis: Clinical Brazilian Perspective

FLÁVIA CLARE, MV, MSC, PHD

Sporotrichosis is a zoonotic mycosis that often affects the dermis, subcutaneous tissue, and even the lymphatic system in animals and humans. It is classified as an anthropozoonosis because it is primarily an animal disease that is accidentally transmitted to humans (Mawby et al., 2018).

The disease is caused by the etiological agent *S. brasiliensis,* considered the causal agent of a major ongoing zoonotic outbreak of sporotrichosis in Brazil emerging in the late 20th century (Teixeira et al., 2014).

S. brasiliensis is a geophilic, thermally dimorphic fungus that exists in a saprophytic mycelial form at room temperature (25–28°C) and transitions to a pathogenic yeast form, characterized by cigar-shaped cells, at 36–37°C. It belongs to the pathogenic clade of the *Sporothrix* genus, along with *S. schenckii sensu stricto*, *S. globosa*, and *S. luriei*, and is predominantly found in South America (Etchecopaz et al., 2021).

Comparative genomic data indicate a distinctive ecological transition in the *Sporothrix* lineage, shifting from an association with plants to parasitism in mammals. This transition enhances our understanding of how environmental interactions influence fungal virulence (Teixeira et al., 2014).

S. brasiliensis is notably associated with transmission via cats, unlike other *Sporothrix* species that primarily rely on sapronotic transmission. A key distinction between these transmission modes lies in the inoculated morphotypes: hyphae and conidia in sapronoses versus yeasts in cat-transmitted cases (Rodrigues et al., 2016).

Sporotrichosis infection can occur through animal-to-animal transmission (e.g., cat-to-cat or cat-to-dog) or zoonotic transmission (e.g., cat-to-human), which is mainly associated with scratches or bites from infected cats. This is likely due to the large number of fungal organisms present in the lesions of infected cats in most cases. Additionally, since the fungus inhabits soil and plant surfaces, transmission can also occur through contact with contaminated plant structures following a puncture or cutting trauma in animals or humans (Schubach & Schubach, 2000; Gremião, 2017).

In Brazil, *S. brasiliensis* is frequently associated with feline infections (96,9%), and has shown greater virulence during epizootic outbreaks, as well as in mouse infection models.

A notable characteristic of *S. brasiliensis* infection is its tendency to cause outbreaks or epidemics among cats, with a high potential for zoonotic transmission (Gremião, 2017). This exacerbated virulence in mice is also observed in the human host, and *S.brasiliensis* is associated with atypical and more severe forms of the disease, including disseminated cutaneous infection in immunocompetent hosts and systemic disease (Rodrigues et al., 2013; Rodrigues et al., 2020).

Feline sporotrichosis outbreaks, driven by *Sporothrix brasiliensis*, have been widely reported in southeastern Brazil, particularly in Rio de Janeiro, São Paulo, Minas Gerais, and Espírito Santo, with similar patterns emerging in southern Brazil and isolated cases in the northeastern region. The outbreaks in Rio de Janeiro began in the 1990s and have shown continuous growth, with over 4,500 human cases and nearly 5,000 feline cases recorded. Zoonotic transmission involving *S. brasiliensis* is largely confined to Brazil, with rare cases in Argentina, while *S. schenckii* has been documented globally, including in the USA, Mexico, and Malaysia. These outbreaks highlight *S. brasiliensis* as a rising threat to human and animal health in Brazil and beyond (Rodrigues et al., 2016).

Many aspects of the emerging mycosis caused by *Sporothrix brasiliensis*, which presents severe clinical forms in both immunocompetent and immunocompromised hosts, remain poorly understood. Critical questions include the high susceptibility of cats to this fungal species, the virulence of *S. brasiliensis* likely linked to its recent introduction into urban feline populations, and the mechanisms behind the emergence of feline sporotrichosis (Almeida-Paes et al., 2014).

Cats' behaviors and lifestyle may partially explain their role as key transmitters of sporotrichosis. Activities such as roaming, living in peridomestic areas, scratching surfaces, toileting in soil, mating, and engaging in territorial disputes (resulting in bites and scratches) facilitate the spread of the fungus to other susceptible hosts. Additionally, cats are common pets with close contact to humans and are major predators of rats. Studies by Lutz and Splendore have shown that rats can acquire sporotrichosis through ingestion, suggesting a possible transmission route whereby cats may have become infected by consuming infected rats. This may have allowed the fungus to adapt to the specific conditions of cat saliva (Etchecopaz et al., 2021).

Notably, the environment of cat saliva, with a pH of 7.5–8.0 and a body temperature of 37.7–39.1°C, resembles conditions found in decaying plant material an environment *Sporothrix* species rely on for growth. These conditions, including high temperature and humidity during decomposition and fermentation, may induce metabolic changes and oxidative stress in the fungus, triggering a morphological shift that supports invasive yeast growth. This host shift from plants to animals highlights a complex ecological and evolutionary adaptation that warrants further study (Almeida-Paes et al., 2014).

Since the first documented cases of *S. brasiliensis* transmitted by cats in Rio de Janeiro around 2000, over 12,000 human cases were recorded in that state by 2017. By 2018,

cases of cat-transmitted sporotrichosis (*CTS*) had spread further, emphasizing the need for a deeper understanding of this unique zoonotic disease (Gremião et al., 2020).

Clinical aspects

Cats are the most affected animals by sporotrichosis, with skin ulcers being the primary clinical sign observed. Feline sporotrichosis presents a wide range of clinical manifestations, from isolated skin lesions to severe disseminated systemic forms that can be fatal. The most common clinical presentation involves multiple cutaneous lesions with mucosal involvement, particularly affecting the nasal mucosa. However, in some cases, cutaneous lesions may be absent. Other mucosal sites, such as the conjunctiva, oral cavity, and genital areas, can also be affected. Additionally, lymph node enlargement is frequently observed, whereas lymphangitis occurs less commonly. Systemic involvement and respiratory symptoms are frequent in cats, often leading to severe cases that are challenging to treat and can result in death. Interestingly, the severity of systemic involvement in cats does not appear to be associated with immunodeficiency caused by coinfection with feline retroviruses (Gremião et al., 2015; Gremião et al., 2020).
Laboratory Diagnosis

In feline species, cytopathology and histopathology are extremely useful for diagnosis. However, fungal culture in the laboratory of tissue and exudate samples for fungal isolation remains the gold standard and the definitive diagnostic method for diagnosing human and feline sporotrichosis. This method demonstrates high sensitivity in both cases, particularly when the sample consists of pus from lesions. However, a negative culture result does not rule out (Rodrigues et al., 2020).

Confirmation of a fungal disease diagnosis is achieved by isolating the agent in Sabouraud dextrose agar culture media supplemented with cycloheximide (25°C and 37°C), Mycozel® agar medium (37°C), or brain heart infusion agar (37°C). Ideally, cultures should be performed in duplicate, with one sample incubated at 25°C to observe mycelial growth and another at 37°C to observe yeast-like growth associated with parasitism. Both samples should be incubated for 14 days to ensure a more precise diagnosis (Rippon, 1988; Barros et al., 2011; Rodrigues et al., 2022).

The characteristics of isolates incubated at 25°C include an initial cream coloration that gradually darkens to blackish tones due to melanin production. Microscopically, thin septate hyphae and conidia can be observed. Isolates grown at 37°C are characterized by a creamy appearance, with elongated or oval structures visible under microscopy (Marimon et al., 2007; Larsson, 2011). For the culture to be considered negative, it should be maintained for approximately one month (Rippon, 1988; Rodrigues et al., 2020).

In endemic areas, the combination of clinical and cytology diagnosis proves to be highly effective (Pereira et al., 2011; Silva et al., 2015). Depending on the location of the lesion, various materials can be collected to isolate the fungus. Using a swab, it is possible to collect samples derived from secretions and exudates from the nose and lesions,

respectively (Schubach et al., 2002; Schubach et al., 2003). Small fragments of dermis or mucosa obtained via biopsy, aspirated purulent material (Schubach et al., 2004), or even blood-stained content (Schubach et al., 2003) can also be sent for cytology, histopathology and culture.

Cytopathological staining techniques such as Gram, quick Panoptic, Wright, Giemsa, or Rosenfeld are particularly sensitive in animals, especially felines. Cytopathological examination of exudates and skin lesions often reveals a high fungal burden, allowing for the observation of *Sporothrix* yeast cells. These cells appear rounded, oval, or cigar-shaped and are surrounded by a transparent, capsule-like halo, similar to those seen in *Cryptococcus spp.* and *Histoplasma spp.* These structures may be located within macrophages, neutrophils, multinucleated giant cells, or freely dispersed. In cases of feline sporotrichosis, the presence of asteroid bodies is uncommon (Rodrigues et al., 2022).

The quick Panoptic method, a Romanowsky-type staining technique like Diff-Quik, has become widely used in veterinary clinics due to its practicality, affordability, and high utility (Seyedmousavi et al., 2018). This diagnostic method shows a sensitivity ranging from 52.6% to 95% in cats when compared to the reference method, fungal culture (SILVA et al., 2015). However, for non-ulcerated or minimally exudative lesions, the sensitivity of this method may be negatively impacted by high-dose antifungal treatments. In recent years, laboratory diagnosis of feline sporotrichosis typically begins with cytological examination by imprinting lesions on glass slides, followed by fungal isolation through culture Notably, an older diagnostic approach, cell block cytology, has demonstrated an impressive sensitivity of 97.5% in identifying feline sporotrichosis during outbreaks and epidemics (Gonsales et al., 2019).

In the 21st century, identifying *Sporothrix* species has become crucial, with PCR serving as the cornerstone of molecular diagnosis. This technique enables the detection of pathogen DNA from clinical samples using multiplex assays, achieving an impressive sensitivity of detecting as few as three copies of the target (Rodrigues et al., 2022).

Treatment of feline sporotrichosis

There are limited oral antifungal options available for the treatment of sporotrichosis in cats. Itraconazole has demonstrated strong in vitro activity against *S. brasiliensis* strains isolated from cats. However, caution should be exercised when correlating in vitro antifungal susceptibility results with in vivo therapeutic outcomes. Itraconazole (100 mg/cat/24h) combined with potassium iodide (2.5 mg/kg to 5.0 mg/kg/24h) are the most frequently used treatments for feline sporotrichosis, with itraconazole remaining the drug of choice. It also represents an important option for the treatment of refractory cases to itraconazole, especially for those cats presenting nasal mucosal lesions and/or respiratory signs Its effectiveness as a monotherapy has been well-documented in numerous studies (Gremião et al., 2020).

Despite its efficacy, an increasing number of itraconazole-resistant strains have been reported over time. It is important to note that generic itraconazole is a viable alternative to the reference drug, but compounded itraconazole formulations are not bioequivalent and are not recommended for use. These findings underscore the need for careful selection and monitoring of antifungal therapies in feline sporotrichosis cases (Nakasu et al., 2021).

Cats with elevated transaminase levels may benefit from hepatoprotective therapy, such as oral silymarin (30 mg/kg, once daily) or S-adenosylmethionine (SAMe) (20 mg/kg, once daily) (Gremião et al., 2020).

The criterion for curing feline sporotrichosis remains clinical, requiring the complete resolution of all signs. Treatment should be continued for an additional month after clinical cure. Cats with lesions (cutaneous and/or mucosal) on the nasal region and/or respiratory symptoms, treatment should be extended for two months after clinical cure to reduce the risk of recurrence. Clinical cure can be achieved regardless of the initial clinical presentation or co-infection with FIV and/or FeLV. However, recurrence after clinical cure may occur, suggesting the potential for lesion reactivation even after treatment is concluded (Gremião et al., 2020).

Treating sporotrichosis has become increasingly challenging, particularly with the emergence of resistance to azoles and polyenes. Over the past decade, alternative drugs from new discoveries or repurposing efforts have gained attention in basic research, highlighting several molecules with antifungal potential. Among these, hydrazone derivatives have shown significant *in vitro* and *in vivo* activity. Promising advancements are on the horizon to help curb the spread of this emerging and re-emerging disease (Rodrigues et al., 2022).

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TUESDAY, APRIL 29, 2025 | 9:00 AM

El Papel de la Radiología en la Dermatología Veterinaria

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Introducción

Las técnicas de diagnóstico por imagen son una herramienta esencial en el diagnóstico de enfermedades en pequeños animales, ya que ofrece información crítica sobre una amplia variedad de condiciones. Las cuatro modalidades principales de imagen utilizadas en perros y gatos—radiografía, ecografía, tomografía computarizada (TC) y resonancia magnética (RM)—ofrecen beneficios únicos. Comprender cómo funciona cada técnica y cuándo aplicarla es clave para lograr diagnósticos precisos y planificar tratamientos efectivos.

Técnicas de imagen

La radiografía, una de las técnicas de imagen más utilizadas y accesibles, se basa en el uso de radiación ionizante para crear imágenes bidimensionales. Los rayos X atraviesan al paciente y son absorbidos en diferentes grados según la densidad de los tejidos, produciendo imágenes en tonos de blanco, negro y gris. Los huesos, por ser densos, aparecen radioopacos, mientras que las estructuras llenas de aire, como los pulmones o los intestinos, se ven más radiotransparentes. Los tejidos blandos aparecen en tonos intermedios, lo que puede limitar el detalle observable en estructuras de densidades similares. La radiografía es especialmente útil para evaluar el sistema esquelético, incluidas fracturas, enfermedades articulares y tumores óseos. También cumple un papel central en la evaluación de afecciones torácicas como patrones pulmonares, cardiomegalia, efusión pleural y masas. En el abdomen, ayuda a detectar cuerpos extraños, obstrucciones gastrointestinales, organomegalias y urolitos. Aunque las radiografías ofrecen una herramienta inicial rápida y relativamente económica, sus limitaciones en contraste de tejidos blandos y su naturaleza bidimensional deben tenerse en cuenta.

La ecografía representa un enfoque diferente, utilizando ondas de ultrasonido en lugar de radiación. Un transductor emite estas ondas al interior del cuerpo, donde se reflejan a diferentes velocidades según las características de los tejidos. Los ecos se traducen en imágenes en tiempo real, lo que permite una evaluación dinámica de los órganos y sus movimientos. Una de las principales ventajas de la ecografía es su excelente capacidad para diferenciar tejidos blandos, lo que la convierte en una herramienta ideal para evaluar órganos abdominales como el hígado, bazo, riñones, vejiga, glándulas suprarrenales intestinos. En pacientes dermatológicos, la ecografía abdominal es especialmente útil

para la evaluación de enfermedades sistémicas con manifestaciones cutáneas. También puede utilizarse para evaluar la bula timpánica, particularmente en gatos. La localización relativamente superficial y el tamaño grande de la bula timpánica felina permiten realizar imágenes transcutáneas, lo que facilita la detección de líquido o material de tejido blando dentro de la cavidad, convirtiéndose en una herramienta diagnóstica útil y no invasiva cuando la TC o la RM no están fácilmente disponibles. Además, la ecografía permite la obtención guiada de muestras de líquidos, aspirados y biopsias minimamente invasivos.

La tomografía computarizada utiliza rayos X y algoritmos informáticos para generar imágenes transversales del cuerpo. El paciente se coloca dentro de un anillo giratorio (gantry), mientras los haces de rayos X se proyectan desde múltiples ángulos, generando cortes tomográficos detallados que pueden reconstruirse en imágenes tridimensionales. La TC ofrece una excelente resolución espacial y es especialmente poderosa para evaluar regiones anatómicas complejas como el cráneo, la nariz, los oídos y el tórax. Es invaluable para evaluar las bulas timpánicas en casos de otitis media crónica o recurrente y pólipos inflamatorios. También permite una evaluación detallada de masas torácicas como los timomas en gatos que presentan dermatitis exfoliativa paraneoplásica, lo que contribuye al diagnóstico y a la planificación quirúrgica. En pacientes oncológicos, la TC permite una localización precisa del tumor, su estadificación y la planificación quirúrgica. La TC abdominal, especialmente cuando se realiza con contraste intravenoso, puede ayudar a diferenciar tumores suprarrenales, caracterizar lesiones hepáticas y detectar derivaciones portosistémicas. Aunque la TC es rápida y adecuada para muchos casos, implica exposición a radiación ionizante y normalmente requiere anestesia general para evitar artefactos por movimiento.

La resonancia magnética se diferencia considerablemente de las otras modalidades en que no utiliza radiación ionizante. En su lugar, emplea un potente campo magnético y pulsos de radiofrecuencia para alinear los protones de hidrógeno del cuerpo. Cuando el campo magnético se interrumpe brevemente, los protones emiten señales al volver a su alineación original. Estas señales se capturan y procesan en imágenes de alta resolución, particularmente eficaces para visualizar tejidos blandos. La RM es considerada el estándar de oro para la imagen del sistema nervioso. Cumple un papel clave en la evaluación de pacientes con signos vestibulares, ya que permite visualizar el oído medio e interno y detectar cualquier posible extensión hacia el encéfalo. En los casos de otitis interna, la RM proporciona un excelente contraste de tejidos blandos, permitiendo detectar acumulaciones de líquido, inflamación o cambios en el oído interno y estructuras adyacentes como nervios craneales o meninges, lo que resulta fundamental en el diagnóstico de infecciones intracraneales de origen ótico. También puede ser de gran utilidad en casos de hiperadrenocorticismo dependiente de hipófisis, donde permite visualizar la glándula pituitaria con gran detalle, ayudando tanto al diagnóstico como a la planificación terapéutica. A pesar de su superioridad en la resolución de tejidos blandos, la RM requiere más tiempo que la TC, es menos accesible en la práctica general y exige anestesia debido a la duración del estudio y su sensibilidad al movimiento.

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TUESDAY, APRIL 29, 2025 | 10:00 AM

Radiología y Dermatología: Un Enfoque Colaborativo

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Introducción

La colaboración entre radiólogos y dermatólogos es fundamental para el diagnóstico y manejo de enfermedades dermatológicas complejas en medicina veterinaria. Aunque la dermatología se basa principalmente en la exploración clínica, la citología y la histopatología, las técnicas de imagen como la radiografía, la ecografía, la tomografía computarizada (TC) y la resonancia magnética (RM) ofrecen información clave para evaluar trastornos dermatológicos con implicaciones sistémicas. A través de la discusión de casos clínicos, esta sesión destacó cómo la radiología mejora la precisión diagnóstica, especialmente en casos complejos.

Casos en los que la radiología puede ayudar

Una de las afecciones dermatológicas más comunes que requiere estudios de imagen avanzados es la otitis. Mientras que la otitis externa suele diagnosticarse mediante otoscopia y citología, la otitis media e interna requieren estudios de imagen para evaluar estructuras más profundas. La ecografía puede ser útil para detectar la presencia de líquido o material de tejido blando dentro de la bula timpánica, especialmente en gatos. La TC permite una evaluación detallada de las estructuras óseas y es particularmente útil en Bulldogs Franceses y otras razas braquicéfalas propensas a la otitis media, debido a sus conductos auditivos estrechos y engrosamiento de la pared de la bula timpánica, lo que dificulta el uso de la ecografía. La RM es la modalidad de imagen preferida para el síndrome vestibular periférico, ya que permite visualizar con gran detalle la acumulación de líquido y los cambios en tejidos blandos en el oído medio e interno, así como cualquier compromiso del sistema nervioso central (infección intracraneal otógenica secundaria a otitis media o interna). En perros con trastornos vestibulares, la localización de la lesión identificada por RM coincide con los hallazgos quirúrgicos en el 90% de los casos.

El síndrome hepatocutáneo (dermatitis necrolítica superficial) es una afección sistémica con manifestaciones cutáneas que a menudo requiere estudios de imagen. La ecografía desempeña un papel esencial al identificar cambios hepáticos característicos. En perros con síndrome hepatocutáneo, el hígado puede volverse muy hiperecogénico con regiones hipoecogénicas difusas, generando un patrón característico en panal de abeja.

Los timomas también pueden presentarse con signos dermatológicos como dermatitis exfoliativa, especialmente en gatos. Los animales afectados pueden mostrar descamación generalizada y alopecia, síntomas que no siempre hacen sospechar de una masa torácica subyacente. Las radiografías torácicas suelen revelar una masa mediastínica, pero la TC ofrece una mejor resolución para evaluar el tamaño, la extensión y la invasividad del tumor. La imagen avanzada es clave para diferenciar los timomas de otras masas mediastínicas y para planificar la cirugía y el pronóstico.

El hiperadrenocorticismo es uno de los trastornos endocrinos más frecuentemente diagnosticados en perros y a menudo se manifiesta con signos dermatológicos como alopecia, piel fina y calcinosis cutis. Las radiografías son útiles para detectar calcinosis cutis, que aparece como mineralización distrófica en la piel, mientras que la ecografía se utiliza de forma rutinaria como parte del protocolo diagnóstico. El hiperadrenocorticismo dependiente de hipófisis (PDH) representa aproximadamente el 80% de los casos en perros. Si un paciente presenta signos clínicos y hallazgos de laboratorio compatibles con hiperadrenocorticismo, se sospecha PDH si ambas glándulas adrenales aparecen simétricamente agrandadas en la ecografía. En cambio, el hiperadrenocorticismo por tumor adrenal (ATH), que se debe a tumores funcionales de la corteza adrenal, representa alrededor del 20% de los casos. Se debe considerar ATH cuando una glándula adrenal está agrandada, contiene un nódulo o está completamente ocupada por una masa, mientras que la glándula contralateral es pequeña (≤5,0 mm) o no visible, lo que sugiere supresión. En los casos en que se sospecha PDH, se puede realizar una RM o TC del encéfalo para evaluar la glándula hipófisis, lo que ayuda tanto en el diagnóstico como en la planificación del tratamiento.

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TUESDAY, APRIL 29, 2025 | 11:30 AM

Terapia tópica exitosa: como mejorar los resultados en casos complejos

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La terapia tópica ha evolucionado de manera importante en los últimos años, cambiando el acercamiento que tenemos con los pacientes dermatológicos, particularmente en perros. Existen diferentes factores que han impulsado el crecimiento del uso y la efectividad de la terapia tópica como la base del manejo de múltiples condiciones dermatológicas en perros y de menor manera en gatos. Por un lado, el mercado del cuidado de las mascotas ha crecido de manera importante en los últimos años generando posibilidades de invertir en la investigación y desarrollo de nuevos productos y nuevas aplicaciones resultando en avances importantes en la tecnología utilizada en los productos disponibles para perros y gatos.

El enfoque principal de esta sesión es el manejo de las infecciones recurrentes en perros con dermatitis atópica. La terapia tópica en el manejo dermatológico de perros tiene los siguientes objetivos clínicos:

1. Control y prevención de infecciones.
2. Control y manejo de la comezón.
3. Mejoramiento y estabilización de la barrera cutánea.
4. Regulación de la queratinización, manejo de la seborrea y desordenes de queratinización de diferente origen.

Es importante mencionar que la terapia tópica rara vez puede funcionar como monoterapia y es esencial integrar diferentes acercamientos al manejo de la enfermedad dermatológica ajustada a cada paciente para poder tratarlos con éxito. En la práctica cotidiana no es raro encontrar casos en los que se ha intentado un manejo repetido con la misma estrategia por periodos prolongados resultando en recaídas, lo anterior genera frustración por parte de los propietarios y el médico tratante.

La pioderma recurrente en pacientes con Dermatitis Atópica Canina es posiblemente la causa singular más frustrante y complicada de manejar; causando ciclos de recaída de prurito que a la vez genera mayor inflamación y lesiones alimentando un ciclo de empeoramiento difícil de romper, así generando un problema que puede ser especialmente retador. La principal causa de pioderma es la Dermatitis Atópica Canina que incluye la causada por alergenos alimenticios, pero es importante en el proceso

diagnóstico descartar otras condiciones como problemas hormonales, desordenes de queratinización y enfermedades inflamatorias e infecciosas de la piel. (1)

Uno de los motivos principales por los cuales la terapia tópica ha ganado prominencia es el problema creciente de resistencia microbiana, por lo cual se ha fomentado el uso de alternativas a los antibióticos rutinarios, considerando el riesgo potencial en la diseminación de estafilococos resistentes entre especies y la reducción de opciones terapéuticas sistémicas seguras y éticas. El uso de productos tópicos antisépticos se ha implementado como una alternativa eficaz en el manejo de las infecciones bacterianas en el paciente canino. (2,3) Este incremento de uso está fundamentado en la recomendación de consenso de opinión de utilizar la terapia tópica como primera alternativa en el manejo de la pioderma superficial y de superficie, en particular en casos en los que se enfrenta con bacterias resistentes. (4) La clorhexidina ha surgido como el antiséptico tópico más utilizado y estudiado en la dermatología veterinaria en diferentes concentraciones, solo o en combinación con otros ingredientes que pueden tener un efecto sinérgico o sumatorio, el uso de este producto deriva de su excelente efectividad demostrada, así como buena tolerancia. (5,6)

A su vez existe preocupación del efecto que tiene el uso prolongado de productos antisépticos, así como en la posible evolución de resistencia microbiana a estos agentes tan ampliamente recetados y la promoción de resistencia a otros antimicrobianos, en particular antibióticos, cuando la clorhexidina es utilizada en dosis sub-letales. (7,8,9)

La búsqueda de alternativas a los antisépticos tradicionales ha llevado a la investigación del uso de productos naturales como aceites esenciales, gluconato de zinc, diferentes antisépticos como el hipoclorito sódico diluido y otros desinfectantes. Lo anterior con el propósito de tener alternativas a la posibilidad del desarrollo de resistencias a los antisépticos utilizados actualmente y en la búsqueda de nuevas alternativas, de preferencia que trabajen de una manera natural y sinérgica con la barrera cutánea y el sistema inmune. (10,11) Existen productos prometedores que han demostrado efectividad, pero muchos de los estudios realizados son pequeños o in-vitro por lo que se requiere de estudios adicionales para poder demostrar su efectividad clínica de manera más amplia; Cabe mencionar que la efectividad comparativa con productos con clorhexidina también depende de la calidad y la formulación de los productos utilizados, se ha demostrado que formulaciones con ingredientes iguales pueden tener diferente efectividad (12,13,14,15) Sin duda la tendencia será en trabajar en mejorar los mecanismos naturales de defensa de la piel y utilizar productos adyuvantes a los mismos, incluyendo la posibilidad del uso de probióticos tópicos (16), o eventualmente la manipulación del microbioma cutáneo, como se realiza en el caso de los trasplantes fecales.

Es importante recordar dentro del manejo de los pacientes con infecciones recurrentes el rol que la barrera epidérmica tiene en el mantenimiento de la salud de la piel. Particularmente en animales con dermatitis atópica se debe considerar que las terapias tópicas deben tener como objetivo restaurar la integridad de la piel, mientras abordan los

factores internos y externos. En la barrera epidérmica factores específicos pueden causar incremento en la presentación de infecciones bacterianas secundarias como pueden ser: niveles más bajos de lípidos, péptidos antimicrobianos, pH más alto, niveles más bajos de filagrinas y mayor sequedad de la piel permiten el sobrecrecimiento y la colonización de *S. aureus*. (17)

Una vez realizado el diagnostico de una infección cutánea es importante seleccionar la manera correcta de tratar al paciente, tomando en cuenta los siguientes aspectos relevantes:

1. Tipo de infección (bacteriana o fungal) establecer la necesidad de uso de productos sistémicos.
2. Determinar la causa primaria de la infección.
3. Factores contribuyentes como inflamación (medicamentos para el control del prurito y la inflamación).
4. Distribución de lesiones (localizado vs. generalizado).
5. Elección de principios activos necesarios en la terapia tópica (propósito del producto).
6. Forma de aplicación del producto (shampoo, toallas, espray, mousse, crema, ungüento, gel).
7. Frecuencia de aplicación y reducción de carga de trabajo.
8. Seguimiento, ajuste de tratamiento.

Para lograr implementar con éxito un plan de tratamiento es necesario trabajar con el propietario y tomar en cuenta al paciente para personalizar y ajustarse a las necesidades específicas del individuo. Por ejemplo, factores relevantes como lo son su tamaño, su tipo de pelaje, las condiciones climáticas y el potencial de resistencia. También debe de considerarse la capacidad del propietario de llevar a cabo los tratamientos, estos criterios son la capacidad física, el espacio para realizar el proceso y la capacidad económica de solventar los gastos requeridos. Por otro lado, debe haber un equilibrio entre la eficacia de los tratamientos y la minimización de los efectos secundarios. Estos últimos pueden ir desde irritación causada por los productos, así como farmacodermias o reacciones más importantes que causen la suspensión del tratamiento implementado. Algunos productos pueden resultar difíciles de emplear y dejar residuos que por su olor, textura o apariencia causen que el propietario no quiera seguir empleándolos.

Cuando se elige una terapia tópica, el clínico debe tomar en cuenta el papel esencial del cumplimiento del cliente en el uso efectivo de terapias tópicas para afecciones dermatológicas. La manera de lograr éxito en la implementación de la terapia tópica requiere de excelente comunicación por parte del equipo veterinario con el propietario o responsable del paciente. Idealmente se recomienda explicar de manera verbal, así como entregar instrucciones escritas claras y en algunos escenarios enseñar como llevar a cabo los baños, o la aplicación correcta del producto. Esto es especialmente importante en perros con pelajes largos y densos donde puede considerarse rasurar el pelaje para optimizar el uso de los productos y mejorar los chances de que estos sean efectivos.

Durante esta sesión discutiremos casos clínicos y estrategias en el uso de diferentes productos y aplicaciones para incrementar el éxito en el manejo de los pacientes con infecciones secundarias recurrentes.

En este espacio de comunicación con el propietario es relevante destacar que el enfoque que sugirió el Dr. Thierry Olivry, en donde el enfoque del tratamiento debe volverse proactivo y preventivo y no reactivo o de rescate. (14) Como clínicos en ocasiones podemos tener claro este concepto, pero es esencial que los propietarios lo entiendan y lo practiquen para lograr prevenir recaídas que son frustrantes y costosas. Los pacientes bien controlados requieren de terapias multimodales en donde la terapia tópica es solo uno de los componentes, así que lograr reducir la carga de trabajo y financiera hacia el propietario promoverá mejor cumplimiento y prevención de recaídas.

Por último, es necesario mencionar las consideraciones financieras en la atención veterinaria, los desafíos que enfrentan los clientes para pagar tratamientos veterinarios pueden ser limitantes así lograr buenos resultados. Es importante equilibrar la eficacia del tratamiento con las realidades financieras de los dueños de mascotas. Un enfoque personalizado del tratamiento y una comunicación clara con los clientes sobre los costos podrían ayudar a garantizar que las mascotas reciban la atención necesaria sin generar una excesiva presión financiera.

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TUESDAY, APRIL 29, 2025 | 2:00 PM

¿Los gatos pueden tener alergias? Signos, tipos y tratamientos

Cats can have allergies too: types of allergies, clinical signs and treatments

DR. MILLIE ROSALES, DVM, DACVD

The challenges of cats with allergies

Before exploring the various allergies that cats can experience, it's essential to recognize the challenges involved in diagnosing allergies in cats. Unlike dogs, cats are not simply smaller versions of them, and what we know about dog allergies doesn't always apply to felines. Identifying a specific allergy in a cat can be particularly difficult because their symptoms often resemble those of multiple different allergies.

Diagnosing allergies can be further complicated for cats that live outdoors or have access to the outdoors, making it difficult to rule out flea or food allergies. Additionally, treating these conditions can be tricky if the owner struggles to administer medications or cannot handle a fractious cat. Cats can also be picky eaters, which complicates food trials. Food trials can also be difficult in multi-cat households or for outdoor cats. Even a thorough exam on a fractious cat can be challenging, and frequent visits for follow-up care may be difficult for both the cat and the owner. Another hurdle is determining whether the cat is truly itchy—sometimes the signs of itchiness are not obvious to the pet owner, leading them to believe their cat is not itchy. Pruritus may also not be evident in cats with eosinophilic granulomas and indolent ulcers, and in some cats with miliary dermatitis.

When taking medical history, it is important to inquire about the cat's environment—whether it primarily lives indoors, outdoors, or a mix of both—to help identify potential exposure to allergens, insects, or infectious organisms. Asking about other animals that may be in close contact with the cat can also assist in evaluating the possibility of contagious issues, like fleas or mites.

Common clinical presentation of allergies in cats

Cats with allergies may show one or a combination of four main signs: head/neck/ear pruritus with excoriations, self-induced alopecia or over-grooming, miliary dermatitis, and

eosinophilic granuloma complex (which includes eosinophilic plaques, granulomas, and indolent ulcers).

Head, Neck, and Ear Pruritus
This condition affects the front of the cat's body, mainly the face, ears, and neck, while the rest of the body typically remains unaffected. Signs include excoriation, erosion, crusts, alopecia, and erythema, and in severe cases, self-inflicted injuries due to intense itching. Blepharitis may also occur, with or without corneal ulcers. The pruritus in these cats can be so severe, making it difficult to control. Physical barriers like e-collars are often necessary to prevent self-trauma.

Self-Induced Alopecia
Self-induced alopecia, also known as symmetrical alopecia, fur mowing, or barbering, occurs when a cat excessively licks, chews, or pulls its hair, leading to bald spots that may be rough or broken due to over-grooming. While redness and skin damage may be present, they are not always evident. The pruritus in these cats is often misdiagnosed as a stress response, like psychogenic alopecia. Excessive licking may also lead to hairballs, causing vomiting.

Miliary Dermatitis
Miliary dermatitis, characterized by small, crusted papules that typically appears on the neck and back. It can be easier to spot on the thinner fur areas, like in front of the ears. The bumps feel like rough grains or sandpaper under the skin. Miliary dermatitis can be itchy, leading to hair loss and excoriation. However, some cats may not show noticeable pruritus, making the condition harder to identify until close inspection reveals the lesions.

Eosinophilic Granuloma Complex (EGC)

Eosinophilic skin lesions are a group of inflammatory lesions that include eosinophilic granulomas, eosinophilic plaques, and indolent ulcers (also known as rodent ulcers). Together, they form what is referred to as **Eosinophilic Granuloma Complex (EGC)**:

Indolent Ulcers: These are typically unilateral, crater-like lesions found on the upper lip, often near the mucocutaneous junction. They can develop without other symptoms. In some cases, they may progress to fibrotic, deformed lips. While generally not pruritic, infections can complicate the condition, causing additional discomfort.

Eosinophilic Granulomas: These firm, well-defined lesions are often linear in shape, appearing on the back of the thighs (referred to as "linear granulomas") or under the chin (sometimes called "fat chin"). They may or may not be itchy and can occasionally develop in the mouth, causing symptoms such as difficulty swallowing, drooling, loss of appetite, or even breathing difficulties, depending on the size and location of the lesion.

Eosinophilic Plaques: These shiny, red, moist lesions are typically found on the ventral abdomen or inner thighs. They are usually associated with intense itching, leading to hair

loss from over-grooming. These lesions can appear as individual spots or merge into larger patches. The constant itching and inflammation associated with eosinophilic plaques can result in secondary bacterial infections, making the condition particularly challenging to manage.

Ectoparasites and skin infections

Before diagnosing allergies as the cause of a cat's skin problems, it is important to consider other potential conditions, both common and uncommon. Various ectoparasites can cause pruritus and dermatitis in cats, often mimicking allergic reactions. Mites such as Notoedres, Otodectes, Demodex gatoi, Cheyletiella, Trombiculid mites, and Lynxacarus should be considered. These ectoparasites tend to affect specific body areas, helping veterinarians narrow down the differential diagnosis. For example, Notoedres, Otodectes, and Trombiculid mites are commonly found on the face, head, and ears, while Cheyletiella and Lynxacarus affect the dorsum, perineum, and tail base. Diagnostic tests like skin scrapings, hair plucks, and ear smears can help identify these mites, and testing other pets in the household may be useful, especially since many mites are contagious. If taking these diagnostics is difficult due to a fractious cat or there is an index of suspicion, an empirical trial using isoxazoline over a 2-month period can be done and observed for improvement.

Additionally, although dermatophytes are not typically pruritic, they should be ruled out in all cats with skin lesions and itching due to their prevalence. Cats with miliary dermatitis are often allergic, but other causes like Cheyletiella, Otodectes cynotis, and infections such as dermatophytes should also be considered. A fungal culture is essential for ruling out dermatophytes.

Skin infections, such as bacterial and *Malassezia* infections, are less common in cats than in dogs, but they do occur and can significantly contribute to pruritus and other clinical signs. Unfortunately, skin lesions in cats are often not sampled for cytology when they should be, which can delay the identification and treatment of secondary infections. For example, eosinophilic plaques in cats often harbor bacterial infections, and failing to treat these infections can make allergy therapy less effective. While cats are not typically prone to *Malassezia* infections, many atopic cats do develop secondary yeast infections, leading to erythematous, brown discoloration of the skin and coat. Simple skin cytology, such as impression smears or tape sampling, is an effective way to identify bacterial or yeast infections. Malassezia overgrowth can sometimes signal underlying systemic issues but is also common in allergic cats. If infections are present, they should be treated with appropriate antimicrobial therapy before starting a workup for allergic skin disease. This ensures a more accurate assessment of the severity of the skin condition and helps better assess the response to allergy therapies.

Flea allergic dermatitis

Flea allergy is the most common allergy in cats, even for those that are strictly indoors. Flea allergy can cause clinical signs like miliary dermatitis, self-induced alopecia, facial dermatitis, and eosinophilic granuloma complex, with or without pruritus or self-trauma. Since flea allergy can overlap with other allergic conditions, it is important to rule out fleas before diagnosing a cat with an atopic disease. Any cat with pruritus should have flea allergy ruled out through a 9–12-week trial of flea prevention, such as an isoxazoline product. Simply not seeing a flea on the cat does not rule out flea allergy, as cats often groom and may ingest fleas, making them invisible. This is especially true for cats that overgroom due to itching. It is also challenging to fully rule out flea allergies in outdoor cats since no flea product is 100% effective. Outdoor cats may still encounter heavily infested areas, and flea prevention can only do so much. Keeping the cat indoors and using flea prevention is the most effective way to rule out flea allergies, though it may take some time to transition an outdoor cat to an indoor lifestyle. In addition to flea prevention, environmental flea control is crucial. Both indoor and outdoor environments should be treated to eliminate flea eggs, larvae, and pupae. All pets in the household should be on flea prevention to prevent re-infestation, even if they do not show symptoms.

Food allergy

If a cat presents with a year-round pruritus, a food allergy should be considered, and an elimination diet trial should be initiated. Food allergies can mimic atopic disease, presenting the same four clinical allergy patterns. Concurrent extracutaneous signs like vomiting, diarrhea, and flatulence can further raise suspicion for food allergies. The cat should be placed on a prescription novel protein or hydrolyzed diet for 2-3 months, and the pet owner should monitor for improvements in the clinical signs. By two months into the trial, cats with food allergies typically show a 90% or more improvement. During the diet trial, it is essential to control pruritus to keep the cat comfortable, with glucocorticoids being the most effective option, tapered over a 4–6-week period.

The challenge in conducting a food trial lies in getting the cat to accept the prescribed food, as preferences for canned, stew, or dry food vary. It is crucial to ask the owner about the cat’s food preferences before starting. In multi-cat households, owners may need to feed all the cats the same food or separate them to ensure the trial's success. Free-choice feeding can complicate this, especially if the owner is not willing to change all cats' food. If the cat improves on the prescribed diet, a rechallenge with previous foods can help identify the specific allergen. This step is essential to confirm a food allergy and rule out seasonal changes as the cause of improvement. If the owner declines the rechallenge, the cat can remain on the prescription food indefinitely, as these diets are nutritionally balanced.

Feline atopic skin syndrome

Feline atopic skin syndrome (FASS), formerly referred to as feline atopic dermatitis and non-flea, non-food induced hypersensitivity, is a recently updated term for allergy-related skin disease in cats, specifically caused by environmental allergens like dust mites, pollen, and molds. FASS is a diagnosis of exclusion, and it is often made when food allergy is ruled out or when seasonal symptoms persist despite a food trial. FASS is most diagnosed in young cats, typically between 6 months to 4 years old, with a median onset around two to three years. Female cats are more frequently affected, and it is less common in cats over seven years old. Unlike dogs, where the condition is better understood, the pathogenesis of FASS in cats is still unclear, and the immunological mechanisms behind it are not as well established. The role of genetics in FASS is also still not fully understood, although it is believed that there may be a genetic predisposition to the disease. Immunological factors, especially the involvement of IgE, are thought to play a role in allergic skin reactions in cats, although IgE's exact function is still debated.

In allergic cats, skin lesions show an immune response like that of dogs and humans with atopic dermatitis, with an increase in immune cells like dendritic cells, eosinophils, mast cells, and T-cells, particularly Th2 cells. Additionally, elevated levels of cytokines like IL-31 have been detected, indicating they may contribute to inflammation in FASS. While barrier function plays a significant role in atopic dermatitis in humans and dogs, its importance in FASS is less clear.

FASS presents a variety of cutaneous reactions, including miliary dermatitis, self-induced alopecia, head and neck pruritus, and eosinophilic granuloma complex. These lesions can appear in different combinations and locations on the cat's body, making FASS less predictable than atopic dermatitis in dogs. In addition to skin signs, allergic cats may experience ear infections, sinusitis, conjunctivitis, and even respiratory issues like asthma. Ear infections in these cats often manifest as ceruminous otitis without bacterial or yeast involvement.

Therapy Options for Feline Atopic Skin Syndrome (FASS)

Feline Atopic Skin Syndrome (FASS) is a chronic condition that requires lifelong therapy, and treatment options for managing pruritus and inflammation include **glucocorticoids**, **cyclosporine**, **oclacitinib**, **antihistamines**, **supplements**, and **immunotherapy**. Although treatment choices are more limited for cats compared to dogs, a combination of these therapies can help manage symptoms.

1. Glucocorticoids:

Glucocorticoids are a first-line treatment for FASS due to their broad anti-inflammatory effects. In cats, **prednisolone** (1-2 mg/kg), **methylprednisolone** (0.8-1.6 mg/kg), or **dexamethasone** (0.1-0.2 mg/kg) are commonly used. Treatment typically starts with a higher dose to control symptoms and is gradually tapered down to the lowest effective

dose. **Methylprednisolone acetate** can also be used for long-acting relief at a dose of 15-20 mg/cat every 3-6 weeks.
Side Effects: Long-term glucocorticoid use can lead to side effects such as skin thinning, increased susceptibility to infections (e.g., dermatophytosis), diabetes, and polydipsia. Regular monitoring of lab work is essential, especially with long-term use. **Hydrocortisone aceponate**, a topical corticosteroid, can be an alternative to reduce reliance on systemic medications and has minimal systemic absorption in cats.

2. Cyclosporine:

Cyclosporine (7 mg/kg orally once daily) is an immunosuppressive drug that inhibits T-cell activation and is effective in managing FASS in cats. Once clinical remission is achieved, the dose can be reduced to every other day or twice weekly.
Side Effects: Gastrointestinal upset (vomiting, diarrhea) is the most common side effect, which may decrease over time. Rare side effects include gingival hyperplasia, weight loss, and liver issues. Cats with Toxoplasma gondii infection may experience more severe symptoms, so testing for Toxoplasma is recommended before treatment in outdoor cats or those on a raw meat diet.

3. Oclacitinib (Apoquel):

Oclacitinib is a Janus kinase inhibitor approved for use in dogs, but it is sometimes used off-label for FASS in cats. A typical dose is **1 mg/kg every 12-24 hours**. Studies have shown it to be effective in reducing pruritus and skin lesions, with results comparable to glucocorticoids.
Side Effects: Oclacitinib is generally well tolerated, but mild increases in kidney values have been noted in some cats. Long-term safety remains unproven, so regular monitoring of hematology and biochemistry is recommended.

4. Antihistamines:

Antihistamines, like **chlorphenamine** or **cetirizine**, block histamine at the H1 receptor and may offer some relief from pruritus, though their efficacy in cats is limited. **Cetirizine** (5 mg daily) showed a 41% reduction in pruritus in some studies. However, antihistamines are typically more effective for mild or early-stage disease, and they often require trial and error to find the right one for each cat.
Side Effects: First-generation antihistamines can cause sedation, and side effects are usually mild.

5. Supplements:

Omega-3 and Omega-6 fatty acid supplementation can help manage allergic dermatitis in cats, although effects may take 6-12 weeks to appear. Supplementation may reduce the need for glucocorticoids in some cases.
Palmitoylethanolamide (PEA), a naturally occurring lipid, can also reduce pruritus and

inflammation. A study showed that **10 mg/kg daily** of PEA improved pruritus and skin lesions in cats with eosinophilic granulomas and plaques.

Side Effects: These supplements are generally safe, but palatability issues may arise, especially with cats that are picky eaters.

6. Immunotherapy (Allergen-Specific Immunotherapy - ASIT):

Immunotherapy is the only treatment that can potentially provide long-term relief and even allow for the reduction or discontinuation of other therapies. It involves administering vaccines based on allergens identified through testing, which aims to shift the immune system's response and promote tolerance.
Effectiveness: 50-80% of cats show significant improvement, with some reaching a 50% or greater reduction in symptoms. Immunotherapy is generally considered safe but can cause rare side effects, such as increased itching or anaphylaxis, though these are less common in cats than in dogs.
Side Effects: Injections are generally safe, but reactions such as increased itching or anaphylaxis may occur, especially in the early stages.

Conclusion:

Management of FASS in cats requires lifelong therapy, often combining several approaches to control pruritus and inflammation. Glucocorticoids and cyclosporine are commonly used, with oclacitinib as a promising off-label option. Antihistamines and supplements may provide mild support but are not typically sufficient for controlling the condition on their own. Immunotherapy offers the potential for long-term remission but requires careful consideration and monitoring. Regular veterinary monitoring is essential to adjust treatments and minimize side effects.

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TUESDAY, APRIL 29, 2025 | 3:00 PM

Manejo de Pénfigo Foliáceo Canino en la Práctica Veterinaria: Terapias Efectivas y Avances

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Información general del pénfigo foliáceo canino:

El penfigo foliaceo (PF) es la enfermedad autoinmune de la piel mas comunmente diagnosticada en perros y gatos. (1,2,6) Esta condicion puede ocurrir de manera espontanea (idiopatica) o puede ser asociada con reacciones a ciertos medicamentos tales como cefalosporinas, penicilinas, trimetoprima-sulfonamida y productos topicos “spot-on” que contienen Amitraz. (1,3,6,7) Otros factores que influyen en el Desarrollo de esta enfermedad es la exposicion a los rayos UV. (1)

Patogénesis:

El PF afecta la epidermis y se desarrolla cuando los anticuerpos atacan a los desmosomas que unen a los queratinocitos. En particular atacan la caderina desmosomal DSC1 en la piel canina (1,4). Esto resulta en la formacion de espacios entre los queratinocitos, tambien conocido como “acantolisis” y los queratinocitos se desprenden de la epidermis. Los queratinocitos que han perdido su adhesion se conocen como “queratinocitos acantoliticos”. (1)

Características clínicas:

Las lesiones primarias consisten en pustulas esteriles y erosiones que progresan a costras y acompanadas por alopecia y descamacion. Estas se pueden distribuir de forma simetrica por el area facial (puente nasal, orejas, alrededor de los ojos), superficies ventrales y las almohadillas plantares, pero puede generalizarse. Otros sintomas que podemos apreciar es prurito, dolor y en casos severos hasta se puede apreciar fiebre, anorexia y letargo. Se han reportado ciertas razas que son predispuestas a esta condicion como los Akitas, Chow-Chows y Bulldogs. (1,5)

Diagnósticos:

Como parte de los diagnosticos, el historial y hallazgos del examen fisico apoyan la sospecha clinica. Se puede comenzar con citologias obtenidas de pustulas intactas o de la superficie de erosiones cubiertas por costras. La evaluacion microscopica revelara un gran numero de neutrofilos y/o eosinofilos, pocas bacterias y

queratinocitos acantoliticos. Hay casos donde puede ocurrir una infeccion secundaria por bacterias y en estos casos se recomienda tratar la infeccion primero antes de hacer diagnosticos adicionales (i.e. biopsias). (1,5) Las pruebas de sangre no brindan resultados especificos para el PF. En algunos casos se puede apreciar leucocitosis caracterizada por una neutrofilia y anemia normocitica, normocromica no regenerativa. Este tipo de analisis se puede utilizar para establecer valores basales antes de comenzar tratamientos. (5)

El diagnostico definitivo es la biopsia. A nivel histologico, se pueden apreciar pustulas subcorneas con acantolisis, lo que confirma la presencia de queratinocitos disociados.

Ademas, podemos apreciar una infiltracion predominante de neutrofilos con presencia ocasional de eosinofilos. Las pustulas pueden ser grandes y expandir hasta varios foliculos, lo que es una caracteristica que marca diferencia entre el PF y una foliculitis bacteriana. (1,2,5)

Tratamientos:

Los glucocorticoides son considerados como la primera linea de tratamiento. (1) Esto es debido a su efectividad rapida a nivel de inmunidad humoral y celular. La prednisone o prednisolona se utilizan inicialmente con dosis inmunosupresoras (2-4 mg/kg/dia). Se mantienen en este tratamiento por los primeros 10-14 dias hasta lograr remision, seguida de reduccion gradual. (5,7) Los glucocorticoides inyectables de accion prolongada como el acetato de metilprednisolona (DepoMedrolR, Zoetis) no son recomendados para manejar esta condicion debido a que la dosis debe ser ajustada con base en la respuesta del paciente. (5) En casos refractarios que no responden a la prednisona o prednisolona, se pueden considerar otros glucocorticoides orales como metilprednisolona, triamcinolona o dexametasona. La metilprednisolona es mas potente que prednisolona (6) y su dosis se puede calcular obteniendo la dosis de prednisolone en mg/kg y se multiplica por 0.8. La dosis inicial de triamcinolona es de 0.2-0.6 mg/kg/dia y la dosis inicial de exametasona es de 0.2-0.4 mg/kg/dia. Las dosis igualmente deben ser reducidas hasta lograr un mantenimiento cada 48-72 horas (5). Efectos secundarios comunes incluyen poliuria, polidipsia, polifagia, inmunosupresion y hepatopatia inducida por esteroides. A largo plazo, incluyen ulceras gastricas, diabetes mellitus, hepatopatia, calcinosis cutis, y atrofia cutanea. (1,5,7) Debido al alto riesgo de efectos secundarios con glucocorticoides, es recomendado comenzar al paciente en un medicamento secundario para asi poder bajar la dosis del glucocorticoide (1,5,7).

La azatioprina es un inmunosupresor utilizado en combinacion con glucocorticoids para reducir la dosis de esteroides. La dosis es de 2 mg/kg cada 24 horas por las primeras 6-8 semanas y luego se disminuye a 2 mg/kg cada 48 horas. Este tratamiento requiere monitoreo con pruebas de sangre cada 2 semanas durante las

primeras 6 semanas de ratamiento debido a la posibilidad de toxicidad hepatica y mielosupresion. (1,5,7)

La ciclosporina (Atopica™, Zoetis; Sporimune™, Dechra; CyclavanceR, Virbac) es un inhibidor de calcineurina que reduce la activacion de linfocitos T. La dosis recomendada es de 5-10 mg/kg/dia. (7) Este medicamento se tarda alrededor de 4-6 semanas en ser efectivo y se le da al paciente mientras esta tomando un glucocorticoide diario para brindarle alivio. Luego de las primeras 4-6 semanas, se comienza a bajar la dosis del glucocorticoide. El ketoconazol (2.5-5 mg/kg/dia) se utiliza en algunos casos con el fin de aumentar la concentracion de la ciclosporina. (7) Efectos secundarios incluyen vomitos, diarrea, hiperplasia gingival e hipertricosis.

El tacrolimus 0.1% es un inhibidor de calcineurina topico. Se puede considerar para usar en lesiones localizadas, especialmente en cara y pabellon auricular. Este medicamento tiene menos efectos adversos sistemicos en comparacion con la ciclosporina. Se puede comenzar aplicando cada 12 horas y una vez se logre remision, se puede disminuir la dosis.

La combinacion de tetraciclina y niacinamida se ha utilizado con exito variable en perros. Puede ser mas efectiva en casos localizados, como el penfigo foliaceo limitado a la cara o el penfigo eritematoso. La tetraciclina tiene propiedades antiinflamatorias que afectan la produccion de anticuerpos, la quimiotaxis, la sintesis de prostaglandinas, las lipasas y las colagenasas. (7) La niacinamida inhibe la degranulacion de los mastocitos y la fosfodiesterasa. (7) Las reacciones adversas incluyen vomitos, diarrea, anorexia y aumento de las enzimas hepaticas. Las dosis recomendadas para tetraciclina son 5-10 mg/kg cada 12 horas y para niacinamida se puede dar 500 mg cada 8 horas para perros que pesen mas de 10 kg y 250 mg cada 8 horas para perros que pesen menos de 10 kg. (6,7) La respuesta clinica puede tardar entre 1 y 2 meses. Si se observa mejoria clinica, la frecuencia de administracion puede reducirse a dos veces o incluso una vez al dia. (7)

El micofenolato es otra alternativa inmunosupresora la cual inhibe la proliferacion de linfocitos. Puede ser util en casos refractarios a esteroides, azatioprina y ciclosporina. Los principales efectos secundarios incluyen supresion de la medula osea, nauseas, vomitos, diarrea y un aumento en la incidencia de infecciones. No presenta toxicidad renal ni hepatica significativa. En un estudio reciente, solo 2 de 11 perros lograron una remision completa con micofenolato. Las dosis variaron entre 22 y 45 mg/kg/dia, divididas cada 12 horas. (7,9)

Manejo ambiental:

Es importante educar a los duenos con el manejo ambiental. Se recomienda evitar la exposicion solar excesiva ya que la radiacion ultravioleta puede exacerbar las lesiones y activar el sistema inmune, agravando la enfermedad. Los duenos pueden

usar protectores solares para perros especialmente en areas despigmentadas o sin pelo. Se recomienda evitar los paseos durante horas de alta exposicion solar (10am-4pm). Se recomienda sacar a los perros en la manana o tarde para minimizar la exposicion al sol. En algunos casos, el uso de camisetas o trajes de proteccion UV puede ser util en perros con lesiones extensas. (1,5)

Tratamientos nuevos:

Se ha reportado el uso de oclacitinib (ApoquelR, Zoetis) como opcion para manejo de PF y otras enfermedades autoinmunes. (10-13) Las dosis reportadas para el manejo de condiciones autoinmunes varian entre 0.6-1.0 mg/kg cada 12 horas. Oclacitinib es un inhibidor de JAK1 y JAK2, lo cual modula la respuesta inflamatoria y disminuye la actividad de las citocinas proinflamatorias. Puede ayudar a reducir la dosis de glucocorticoides en pacientes con efectos adversos. Un estudio retrospectivo (10) comparo el efecto de oclacitinib comparado a azatioprina en perros con PF y encontraron que oclacitinib redujo significativamente la dependencia de glucocorticoides y mostro una mejor tolerabilidad en terminos de efectos secundarios. Las inyecciones de glicosaminoglicano polisulfatados (Adequan CanineR, American Regent Animal Health) son otra alternativa que se puede considerar como parte del manejo de PF. Tiene propiedades antiinflamatorias y puede contribuir a la reparacion de la barrera epidermica. Un estudio reporto tres perros con PF que fueron tratados con inyecciones de glicosaminoglicano polisulfatados como tratamiento adicional a la terapia inmunomoduladora sistemica. Estos pacientes no fueron controlados adecuadamente con glucocorticoides orales en combinacion con ciclosporina, azatioprina y/o micofenolato. Las inyecciones de glicosaminoglicano polisulfatados contribuyo a la induccion de la remision y permitio reducir las dosis de glucocorticoids en todos los perros. (14) Se requiere mas evidencia clinica para definir su efectividad en PF.

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TUESDAY, APRIL 29, 2025 | 4:30 PM

Los 10 si y no de la Otitis externa

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Otitis externa, is a prevalent condition characterized by inflammation of the external ear canal and can result from a variety of factors, including infections, allergies, and anatomical predispositions. The prevalence of otitis externa in dogs has been documented extensively, with studies indicating that it is one of the most common disorders seen in veterinary practice. For instance, a study found that otitis externa accounted for 10.2% of diagnoses in a multi-breed population of dogs in the UK, making it the most common disorder recorded. Similarly, in the US, it was noted in 13% of veterinary consultations, highlighting its widespread occurrence (O'Neill et al., 2017).

The etiology of otitis externa is multifactorial, often involving a combination of predisposing, primary, and secondary factors. Predisposing factors include breed characteristics, such as ear conformation; breeds with pendulous ears, like Cocker Spaniels and Bichon Frises, are particularly susceptible (Lehner et al., 2010; Tesin, 2023). Additionally, environmental factors and underlying conditions such as allergies, particularly atopic dermatitis, play a significant role in the development of otitis externa (McGreevy et al., 2018; O'Neill et al., 2017). In fact, it has been reported that approximately 75% of otitis externa cases are associated with atopic dermatitis (McGreevy et al., 2018).

As otitis externa being a underlying condition is really important for the practitioner to find and control the primary cause. Most general practitioners are worried abut secondary infections even mora than for inflammation of the ear canal ad if so, most of the treatments forget the fundamental part of the primary cause; being allergies the top cause for recurrent otitis externa.

There are several things we need to have in mind when approaching ear disease and we must not forget a few things that may help us control the case from its origin.

1.- Don't forget the pinna

inflammation of the ear pinnae, encompasses various etiologies, including infections, allergies, and anatomical predispositions. Anatomical factors such as ear conformation and excessive hair in the ear canal further predispose specific breeds to pinna dermatitis.

Autoimmune diseases, especially pemphigus foliaceous, significantly impact the pinna in affected dogs and cats. Pemphigus foliaceous is characterized by the presence of autoantibodies targeting keratinocytes, leading to acantholysis and the formation of vesicles and erosions, often prominently observed on seborrheic areas like the pinnae. In a recent study 46 of 91 doigs with pemphigus foliaceoius presented pinna lesions. (Mueller 2006)

Vasculitis can occur in association with severe forms of dermatitis, often leading to painful lesions and systemic manifestations. In cases related to autoimmune mechanisms such as pemphigus foliaceous, vasculitis may present as erythema and necrosis around the pinna, indicating a more significant compromise to the vascular supply to the area. Vasculitis of the pinnae may hide and underlying condition as tick or flea borne diseases. (Southern 2018)

Auricular chondrititis may cause an inflammatory and localized process deriving in pain and inflammation of the ear pinna. (Noxon 2020)

2.- Explore the ear canal

Otoscopic examination serves as a cornerstone in the diagnostic evaluation of otitis externa. Utilizing a conventional otoscope enables clinicians to assess the integrity of the ear canal, detect pathological changes such as exudate or inflammation, and evaluate the status of the tympanic membrane. Video otoscopy, an advanced diagnostic modality, further enhances visualization by providing high-resolution, real-time imaging and the ability to document findings, thereby facilitating more precise assessment and longitudinal monitoring of ear canal pathology.
The diagnostic accuracy of otoscopy is pivotal in guiding clinical decision-making, including the selection of appropriate medical or surgical interventions. Of particular importance is the assessment of the tympanic membrane, as its integrity (or lack thereof) plays a critical role in differentiating uncomplicated otitis externa from cases involving concurrent otitis media. (Cole 2003)

3.- Cytology, cytology and cytology

Ear cytology is an essential diagnostic tool for evaluating otitis externa, allowing clinicians to identify secondary microbial agents—such as bacteria and yeast (*Malassezia* spp.)—that contribute to inflammation and infection. Given that the ear canal's unique anatomy fosters microbial proliferation, cytology provides rapid, actionable insights into pathogenic overgrowth, distinguishing between commensal flora and pathological involvement.

Key findings from cytological assessment include:

- Malassezia pachydermatis, a common fungal agent in dogs, and *Malassezia* spp. in cats, which frequently proliferate in diseased states.
- Bacterial cocci and rods, often indicating secondary infections requiring targeted therapy.

- Inflammatory and hyperplastic changes, such as ceruminous gland hypertrophy and epidermal hyperplasia, which may lead to canal stenosis if left untreated.
- Cytological evaluation is crucial for accurate diagnosis, guiding treatment and selecting appropriate topicals and monitoring clinical response. (Lehner 2010)

4.- Imaging in ears

Advanced imaging modalities—radiography, CT, and MRI—play a crucial role in diagnosing and managing otitis externa and media in dogs and cats. Each technique offers distinct advantages, aiding in accurate diagnosis, treatment planning, and detection of complications.

Radiography

- Primary Use: Initial screening for bony changes (e.g., tympanic bulla sclerosis, osteolysis).
- Key Findings: Soft tissue opacity in the bulla (suggesting effusion/infection) or chronic osseous remodeling.
- Limitations: Poor soft tissue detail; indirect evidence of disease.
- Best For: Early assessment of chronic otitis or when advanced imaging is unavailable.

Computed Tomography (CT)

- Superior Advantages: High-resolution evaluation of bony and soft tissue structures.
- Diagnostic Value:
  - Detects osteomyelitis, neoplasia, or inflammatory polyps.
  - Differentiates otitis media vs. externa and assesses bulla involvement.
  - Guides surgical planning (e.g., bulla osteotomy for polyps or neoplasia).
- Clinical Preference: First-line advanced imaging for chronic/recurrent otitis. (Bishop 2004)

Magnetic Resonance Imaging (MRI)

- Key Strengths: Unmatched soft tissue contrast for inner ear, meninges, and CNS involvement.
- Ideal For:
  - Suspected neoplasia (e.g., ceruminous gland adenocarcinoma).
  - Neurological complications (e.g., meningitis, brainstem extension).
  - Fluid detection (e.g., labyrinthitis, abscessation).
- Limitations: Higher cost and longer scan time; typically reserved for complex cases.

It is important to obtain imaging from chronic cases especially brachycephalic breeds. In a recent study several patients with chronic otitis presented optitis media without neurological clinical signs evaluated by CT scan. (Belmudes 2017)

5.- To sample of not for bacterial culture in otitis externa.

Bacterial culture and sensitivity may provide data about the infectious agnet but also about the antimicrobial susceptibility. However, in otitis externa most ear treatments are topically based, which from the sensitivity point of view, most of the treatments exceed by far the MICs used in establishing the resistance patterns of the culture and sensitivity results. Due to the fact most of the cultures are established by MICs from systemic antimicrobials, the results may not reflect the reality of a topical treatment regime.

6.- Do not stop treatments prematurely

Chronic inflammation, particularly in otitis externa may lead to inflammatory changes and these may affect the anatomy and physiology of the ear canal. Due that most changes may occur inside the ear canal and some improvement may occur in a few days after treatments on the external part, discontinuing the treatment may be a temptation for the clinician. Failure to explore the ear canal and observe if inflammatory changes remain may cause discontinuation of the treatment prematurely leading to reappearance of clinical signs.

Length of treatment should be based in otoscopic examination, clinical response and cytology.

7.- Don't sub diagnose otitis media

Chronic otitis externa frequently progresses to otitis media (middle ear involvement), with studies suggesting up to 82% of dogs with long-standing ear disease have concurrent middle ear pathology (Cole, 2023). Failure to diagnose and treat otitis media leads to treatment failure, persistent pain, and irreversible complications such as tympanic membrane fibrosis, auditory ossicle damage, and even neurological sequelae.
Key Consequences of Undiagnosed Otitis Media:

1. Therapeutic Failure
    - Topical medications for otitis externa often fail to penetrate the tympanic bulla, leaving middle ear infections untreated.
    - Bacterial biofilms and resistant pathogens (e.g., *Pseudomonas*) are common in chronic otitis media, requiring systemic therapy or flushing.
2. Chronic Pain & Neurological Risks
    - Middle ear disease causes significant discomfort (head shaking, ear rubbing, reluctance to chew).
    - Advanced cases may lead to facial nerve paralysis, Horner's syndrome, or vestibular signs due to proximity to cranial nerves and the inner ear.
3. Structural Damage
    - Prolonged inflammation results in bony proliferation (sclerosis) or lysis of the tympanic bulla, complicating future surgical interventions.
    - Fibrosis and stenosis of the ear canal increase recurrence risk, even after resolution of infection.

Diagnostic Challenges & Solutions:

- Otoscopy: A ruptured or opaque tympanic membrane suggests media involvement, but intact membranes do not rule it out (up to 70% of otitis media cases have an intact TM).
- Imaging:
  - CT is the gold standard—detects bulla effusion, osteolysis, or polyps (present in ~30% of chronic feline otitis cases).
  - MRI is superior for neurological complications (e.g., meningoencephalitis secondary to extension).
- Cytology & Culture:
  - Gram-negative rods (e.g., *Pseudomonas*) in otitis externa should raise suspicion for middle ear involvement.
  - Deep ear swabs or myringotomy samples improve culture accuracy.

Assume otitis media is present in chronic/recurrent otitis until proven otherwise. (Lorek 2020)

8.- Control the inflammation

Corticosteroids remain the cornerstone of anti-inflammatory management due to their potent anti-inflammatory and antipruritic effects. Selection depends on severity, chronicity, and formulation compatibility. It is very important to consider potency, side effects in choosing the correct length of treatment. A combination with topical and systemic steroids is preferred in most cases of otitis extenra, at least at the beginning following to topical use and preferably soft steroids with less systemic absorption.

Topical Steroids include Hydrocortisone aceponate (HCA), Mometasone furoate, Dexamethasone, Triamcinolone. The most used systemic steroids include Prednisolone/Prednisone, Methylprednisolone acetate, Triamcinolone.

9.- Clean the ears.

Proper ear cleaning is a critical component of otitis externa treatment, serving both therapeutic and diagnostic purposes. In clinical practice, a gentle technique is essential to avoid further trauma to the already inflamed ear canal, which can exacerbate pain, increase permeability for pathogens, and delay healing. Appropriate cleaning removes debris, exudate, and biofilm, thereby enhancing the penetration and efficacy of topical medications (Marignac et al., 2019). Studies demonstrate that regular, careful cleaning significantly reduces bacterial and fungal loads, helping to restore a healthier ear microenvironment (Corb et al., 2024).
Evidence supports the clinical benefits of ear cleaning, particularly when using veterinary-approved ceruminolytic and drying solutions. A double-blinded, randomized controlled trial (Corb et al., 2024) found that dogs with otitis externa who received manual ear cleaning had significantly better therapeutic outcomes compared to those treated with medication alone. This underscores that mechanical debris removal is just as crucial as

antimicrobial therapy in managing otitis. However, aggressive flushing or improper technique can cause iatrogenic damage, including tympanic membrane rupture, so a methodical, atraumatic approach is imperative. For optimal results, clinicians should select cleaning solutions based on the type of discharge (e.g., ceruminous vs. purulent) and educate clients on proper at-home maintenance to prevent recurrence.

10.- Find the primary cause.

Finding the primary cause is crucial in order to avoid recurrent otitis externa. Imn dogs, otitis externa is most commonly secondary to atopic dermatitis, which underlies up to 75% of chronic cases. Other primary causes include ectoparasites (e.g., *Otodectes cynotis*), foreign bodies (acute, unilateral presentation), endocrine disorders (hypothyroidism, hyperadrenocorticism), keratinization defects, autoimmune diseases, and rarely neoplasia (e.g., ceruminous gland tumors). Young dogs often present with parasitic otitis, while older dogs are more prone to endocrine or neoplastic causes. Unilateral cases should prompt investigation for foreign bodies or tumors, whereas bilateral involvement typically suggests allergic or systemic disease. Successful management requires identifying and addressing these underlying conditions rather than solely treating secondary infections.

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TUESDAY, APRIL 29, 2025 | 9:00 AM

10: The effect of daily oral probiotic and postbiotic supplementation on the canine skin microbiota: insights from culture-dependent and long-read 16S rRNA gene sequencing methods

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Abstract: The effects of oral daily probiotic/postbiotic supplementation (ODPPS) on the skin microbiota of dogs using both culture-dependent and culture-independent methods have not previously been investigated. This prospective analytical cohort study describes the effect of ODPPS on the microbiota after 30 and 90 days of supplementation using culture-based and full-length 16S rRNA gene sequence analysis. Twelve client owned golden retrievers living in the same environment with no history of dermatological disease had skin (axillae and inguinal) swab samples collected on day 0. All dogs commenced Activ Daily Postbiotic & Probiotic Supplement (Activ Dog Health; Rochedale, Qld, Australia) chews once daily. Skin swab samples were taken from the same sites on days 30 and 90. Swabs were cultured on sheep blood agar at 37°C for 24h, and bacterial colonies were identified. DNA was extracted from the swabs to obtain full-length 16S ribosomal RNA gene sequences for microbiota profiling. Culture-dependent methods demonstrated reduced *Staphylococcus pseudintermedius* prevalence in inguinal tissue following ODPPS (p=0.05). In the axillae, microbiota compositional differences were demonstrated at Day 90 compared to Day 0. A notable increase in beneficial skin-associated bacteria was observed in the axillae at Day 90 of supplementation, including *Dubosiella newyorkensis* (False Discovery Rate (FDR) p=0.02) and *Lactobacillus acidophilus* (FDR p=0.02). Additionally, higher bacterial genera diversity in the axillae was observed on Day 90 of ODPPS. This study provides a comprehensive analysis of the

canine skin microbiota using advanced long-read sequencing, revealing ODPPS as a promising strategy for improving skin health in dogs by modulating the microbiota.

Sources of funding: This work was supported by the 2023 Dermatology Chapter Research Grant from the Australian and New Zealand College of Veterinary Scientists, which provided funding for DNA extraction kits. Dermatology for Animals contributed to sample transportation costs. Activ Dog Health provided the probiotic/postbiotic chews used in this trial and contributed to culture-based sample processing, DNA Library Prep/Sequencing (Full 16S sequence) and bioinformatics/statistical analysis costs. Activ Dog Health was not involved in any step of the study, including the study design, data collection, data analysis, manuscript writing process and the decision to submit the manuscript for publication.

Conflict of Interest: None declared.

TUESDAY, APRIL 29, 2025 | 9:15 AM

40: Clinical and histopathologic features of canine alopecia areata: a retrospective study of 14 cases

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Abstract: Alopecia areata (AA) is an autoimmune disease resulting in non-scarring, non-inflammatory hair loss across mammalian species. This retrospective study aimed to characterize clinical, histopathological, and treatment outcomes of canine AA. Skin biopsies were evaluated from 14 dogs of varying signalment and ages diagnosed with AA based on their clinical history and evidence of peribulbar and intrabulbar mononuclear cell infiltrates. Initial lesion distribution spanned the face, dorsal cranium, and extremities. Eleven dogs had a history of concurrent pruritus; five of those dogs were previously diagnosed with atopic dermatitis. Percentage of anagen bulbs affected were determined and graded on a severity scale based on the diameter of cellular infiltrate. Seventy-one percent (95/134) of anagen hair bulbs were affected. Peribulbar cells were found to consist of lymphocytes in all dogs, plasma cells (13), eosinophils (seven), macrophages (six), and neutrophils (five). Follicular keratosis, common in human AA diagnosis, was present in all samples. Treatment outcomes were available in 13 cases; follow-up ranged from two months – seven years. Oral ciclosporin was the most prevalent treatment (eight dogs) with good success; six with partial and two with complete hair regrowth. Evidence of relapse was seen in four dogs when therapy was tapered or withdrawn. Oral oclacitinib was effective in two patients with partial and complete hair regrowth observed after three and five months, respectively. Unlike previous reports, spontaneous remission was only reported in two cases (15%). These data suggest canine AA is a complex and chronic disease that often requires long-term treatment.

Source of funding: The American College of Veterinary Dermatology Resident Research Grant.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 9:30 AM

41: Microarray gene expression analysis of lesional skin in canine alopecia areata

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Abstract: Alopecia areata (AA) is an autoimmune disease characterized by an aberrant immune-mediated attack of hair follicles, resulting in non-scarring, non-inflammatory hair loss without overt epidermal changes. In contrast to human AA, pathogenesis and molecular mechanisms of canine AA are profoundly understudied. This study aimed to characterize the transcriptome of lesional skin in canine AA (n = seven dogs) using RNA extracted from formalin-fixed paraffin-embedded tissues; five healthy dog samples (n = five) served as a control. From the 780 analyzed genes in the gene expression microarray (NanoString's nCounter Analysis System, NanoString Technologies, Seattle, WA, USA), there were 332 differentially expressed genes (DEGs; p-adjusted value <0.05): 318 upregulated and 14 downregulated. A strong significant upregulation of T-helper (Th) 1/interferon-related markers (*IFNG, CXCL10, CXCR3, GZMB, STAT1, ISG15, MX1*) was observed in canine lesional AA skin. In addition, upregulation was noted in several proinflammatory genes (*TNF-α, IL-6, IL-8, IL-15,* and *IL-18*) and genes associated with the Th2 pathway (*IL-13, IL-4R, CCL5, CCL17, CCL26*). Cell type profiling found enhancement of several cell types such as T cells, mast cells, macrophages, and cytotoxic cells in lesional AA skin compared to healthy. Enrichment analyses of the DEGs showed statistically significant NCATS *BioPlanet* biological pathways related to antigen processing and presentation, TSLP pathway, immune system activation, Th cell surface molecules, interferon signaling, and type 2 interferon signaling. In conclusion, this limited microarray study revealed that canine AA lesional immune signature resembles previously published changes in human AA skin lesions with upregulation of Th1 and Th2 immune responses.

Source of funding: The American College of Veterinary Dermatology Resident Research Grant.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 9:45 AM

39: Agreement between pre-consultation client filled history questionnaire responses and verbal history during a veterinary dermatology consultation

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Abstract: Pre-consultation client-filled history questionnaires are recommended to improve the efficiency of veterinary dermatology consultations. Discrepancies between questionnaire responses and verbal histories may affect the utility of these questionnaires. This prospective study assessed the agreement between pre-consultation questionnaire responses and verbal histories obtained by seven clinicians during initial consultations for 130 canine patients across four veterinary dermatology clinics. The 16 question questionnaire, developed from templates in textbooks, were completed online by clients prior to the consultation. During the consultation, the clinician obtained a verbal history addressing each of these questions. Currently, no validated scoring system exists to evaluate the agreement of the questionnaire responses to verbal history. A non-validated scoring system was developed grouping observed agreement into excellent (> 80% agreement), good (70-80% agreement), and poor (<70% agreement). Statistical analysis (p=0.05) revealed excellent agreement for 62.5% (10/16) of questions, good agreement for 25% (4/16), and poor agreement for 12.5% (2/16). Excellent agreement questions pertained to seasonality, diet, bathing, flea prevention, bowel movements, gastrointestinal signs, polydipsia or polyuria and skin lesion on in-contact pets or humans and if any other medical conditions were present. Good agreement questions pertained to the presenting problem, age of onset, pruritic areas and response to previous medications, and poor agreement questions pertained to pruritus score and current medications. These findings highlight opportunities to refine the questionnaire by retaining questions with excellent agreement and modifying or removing those with lower agreement, ultimately optimizing consultation efficiency and enhancing the history-taking process.

Conflict of interest: None declared.

Source of funding: Self-funded.

TUESDAY, APRIL 29, 2025 | 10:00 AM

42: Informant discrepancy in history reporting between caretakers in veterinary dermatology

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Abstract: Collection of medical history is essential for making informed clinical decisions in veterinary medicine. In veterinary dermatology, historical patterns may alter a clinician's diagnostic and therapeutic recommendations. Patient reporting has similarities to human pediatric medicine, where clinician history is collected from caretakers instead of patients themselves. Informant discrepancy between medical histories taken from co-parents has been observed in human pediatric medicine but has not been assessed in veterinary medicine. The objective of this questionnaire-based, prospective, descriptive study was to investigate informant agreement amongst caretakers of veterinary dermatology patients. A caretaker history questionnaire was designed to assess the primary concern of caretakers, seasonality and duration of clinical signs, pruritus score, areas of the body affected, dietary history, and medication history. At initial dermatology consultations, caretakers completed the questionnaire in separate rooms as blinded pairs. Agreement proportion was analyzed by calculating the proportion of pairs where both caretakers agreed, among all pairs. Fifty-three paired responses (106 caretakers) volunteered for the study. Agreement was highest with histories of gastrointestinal signs (94.1%), skin disease exacerbation by diet (84.3%), and duration of disease (80.4%). Caretakers reported pruritus visual analogue scores within two score units of one another in 61.5% of patients. Individual affected body part agreement and individual protein consumed agreement were 53.5% and 55.7%, respectively. The lowest agreement was seen in seasonality of disease (38.5%) and individual medication use (38.7%). Findings support that informant discrepancy exists between caretaker histories reported in veterinary dermatology, suggesting that all caretakers' histories should be taken into consideration.

Source of funding: Self-funded.

Conflicts of interested: None declared.

TUESDAY, APRIL 29, 2025 | 10:15 AM

34: Clinical and histopathological features of presumed follicular dysplasia in poodle crossbred dogs (doodle follicular dysplasia)

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Abstract: Poodle and related crossbred dogs develop a poorly described dorsal truncal dermatosis informally called, “doodle dysplasia”. The objectives of this study were to characterize the clinical presentation, histopathological findings, and outcomes of affected dogs with dermatopathology samples submitted to two major dermatopathology laboratories in the United States. Dogs were included retrospectively from 2019-2024 (21) and prospectively (3). Follow-up information was requested from owners via an online survey. The average age of onset was 4.4 years with no sex predilection. The most commonly reported season of disease onset was summer (June – August), with 45% of cases. The most common hair coat changes were alopecia located on the dorsum and new growth of hair in a coalescing, serpiginous linear pattern with darker color and straighter, coarser hair texture compared to the original coat. Histological changes were mild. Anagen follicles dominated (23/24) and had mild outer root sheath (23/24) and rare hair bulb apoptosis (16/24). Mostly pigmented follicles (23/24) had minimal altered pigment distribution (17/24). Mild follicular segment elongation, straightening, and thinning were subjective. Sebaceous gland atrophy (15/24) and epidermal hyperpigmentation (16/24) were mostly mild. Of the 12 cases with follow-up information, four dogs reverted to their previous coat color and texture in three to 12 months, and 3/4 dogs had reoccurrence of lesions in 12 or 24 months. Doodle (follicular) dysplasia is non-inflammatory, has a possible seasonal component, and is a differential for dorsal coat color and texture changes, with or without alopecia in poodle and poodle crossbred dogs.

Source of funding: Self-funded.

Conflict of interest: C. Laporte and R. Mount are clinical consultants for Zoetis Reference Laboratories.

TUESDAY, APRIL 29, 2025 | 10:30 AM

35: Clinical, histopathological and molecular characterization of canine epitheliotropic cutaneous T-cell lymphoma enriched with apoptotic keratinocytes: a retrospective case series

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Abstract: Apoptotic keratinocytes have been described with canine epitheliotropic cutaneous T-cell lymphoma (eCTCL) without further characterization of this variation. This study aimed to characterize six confirmed eCTCL cases enriched with apoptotic keratinocytes as a novel cytotoxic variant of canine eCTCL. Canine eCTCL cases from a veterinary pathology diagnostic laboratory database were searched from 2018 to 2024. Hematoxylin and eosin-stained slides were examined for evidence of lymphocytes, apoptotic keratinocytes with lymphocytic satellitosis, and epitheliotropism in the lower half of the epidermis and adnexal structures by a board-certified veterinary pathologist. Immunohistochemistry (IHC) staining for CD3 and C20 was performed in addition to clinical follow up with response to treatment, and polymerase chain reaction for antigen receptor rearrangement (PARR) assay (T and B cell). Various breeds were affected with a median age of 10 years at presentation. Generalized skin lesions included diffuse crusting, scaling, erythema and erosions/ulcerations; mucocutaneous junctions were involved in 3/6 dogs. Per inclusion criteria, histopathology confirmed an interface cytotoxic pattern eCTCL in all cases, marked by lymphocytic epitheliotropism and apoptotic keratinocytes. IHC staining demonstrated >90% strong CD3+ T-cell immunoreactivity in the epidermis and follicular epithelium in all cases. All six confirmed cases showed clonality for the T cell receptor gene using PARR analysis. In conclusion, this cytotoxic variant of canine eCTCL clinically and histologically can resemble other cutaneous diseases with cytotoxic dermatitis (e.g., hyperkeratotic erythema multiforme). IHC, clonality testing, and response to treatment may be necessary for definitive diagnosis.

Conflicts of interest: None declared.

Source of funding: Self-funded.

TUESDAY, APRIL 29, 2025 | 10:45 AM

53: Parakeratotic hyperkeratosis of the pinnae in sixteen French bulldogs

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Abstract: Zinc-responsive dermatosis is a common disease in Arctic breeds, and more recently described in Boston Terriers, characterized by parakeratotic hyperkeratosis. This study describes clinical and histologic features of parakeratosis in French bulldogs that has similarities to zinc responsive dermatosis (ZRD). An additional study objective was to assess response to zinc supplementation. Sixteen French bulldogs, nine males and seven females with a median age of 17 months, with similar clinical and histological findings were identified retrospectively from one database that services a private practice across the United States. Of the 16 cases with hyperkeratotic pinnae, six also had other affected areas, including the nasal bridge, scrotum and dorsal tail. All 16 French bulldogs were confirmed with histopathology, and follow-up information was obtained based on medical records in all 16 cases and email survey in 9/16 cases . Of the 16 dogs that were confirmed with histopathology, 12 dogs received oral zinc supplementation, and eight dogs had documented clinical improvement or resolution of dermatological lesions. Of all sampled dogs, nine were supplemented with an average dose of 1.95 mg/kg zinc methionine (VEDCO NutriVed Chewable Zinpro®, Saint Joseph, MO) once daily per os. When zinc supplementation was discontinued in 4/12 cases, lesions reoccurred but improved when supplementation was restarted in 3/4. Prospective studies in French bulldogs are needed to investigate potential zinc deficiency by evaluating serum and/or tissue levels and to objectively evaluate the effectiveness of zinc supplementation and other therapeutic interventions. Further investigation into ZRD in French bulldogs is recommended.

Conflict of interest: None declared.

Source of funding: Self-funded.

TUESDAY, APRIL 29, 2025 | 11:30 AM

44: A retrospective analysis of cases of canine cutaneous toxic shock syndrome for clues to facilitate an early diagnosis

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Abstract: Cutaneous toxic shock syndrome (CTSS), attributed to exotoxins from *Staphyloccocus* or *Streptococcus*, presents with diffuse erythroderma and peripheral edema with often fatal systemic complications. Published scoring criteria are utilized in human medicine and higher scores correlate to increased likelihood of CTSS. This retrospective study aimed to describe clinical and clinicopathologic findings in canine CTSS and determine the utility of the human CTSS criteria score in dogs. Seven dogs (four females, three males) from two veterinary teaching hospitals were included based on diagnostic histopathologic lesions of coalescing panepidermal cytotoxic dermatitis with neutrophilic satellitosis. Diagnosis was made antemortem in 4/7 and post-mortem in 3/7. Prodromal clinical signs included lethargy (7/7), vomiting and/or diarrhea (3/7), and inappetence (3/7). Primary skin lesions included diffuse erythroderma (7/7), ventral edema (7/7), distal limb edema (6/7) and vesicles/bullae of the concave pinnae (3/7), ventrum (1/7), and perianally (1/7). Clinicopathology changes included anemia (7/7), neutropenia (2/7), neutrophilia (5/7), hypoalbuminemia (7/7), thrombocytopenia (7/7), increased liver enzymes (6/7), and azotemia (4/7). No sources of infection were identified in any dog. Five of seven dogs died or were euthanized three to 12 days after lesion onset; all five received corticosteroids before diagnosis and had a higher human CTSS criteria score. Remaining 2/7 dogs survived with supportive care and antibiotics. CTSS should be considered in dogs with sudden onset of erythroderma with edema and the described clinical signs since early diagnosis is critical. Evaluation of additional dogs is needed to confirm the reliability of human criteria to expedite CTSS diagnosis in dogs.

Source of funding: Self-funded.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 11:45 AM

55: Fluorescent light energy as a treatment of Alopecia X: a prospective randomized double-blinded pilot study

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Abstract: Alopecia X is a canine non-inflammatory hair loss disorder. Treatments have shown variable responses, highlighting the need for alternative therapies. This study aims to evaluate the efficacy of fluorescent light energy (FLE) therapy on hair regrowth in Alopecia X patients. Seven dogs with clinical and histopathological diagnosis received two treatments by affected side, once per week for eight weeks. One randomized area was treated with PHOVIA® (Vetoquinol N.-A. Inc.; Lavaltrie, QC, Canada), while the contralateral side served as a control. Four blinded veterinary dermatologists visually rated hair densities independently using a 5-level ordinal scale on day 0 (D0), after the last treatment on day 50 (D50), and on day 78 (D78). One patient withdrew after D50. The likelihood of improved hair density scores significantly increased with time (p=0.003), but the time*treatment interaction was not significant (p=0.61). However, the scores of the treated side tended to be higher at D78 compared with control. The quadratic-weighted Fleiss Kappa, Brennan-Prediger and Gwet's AC2 inter-rater agreement coefficients respectively were 0.81, 0.84 and 0.88. According to Altman's benchmarking system, their 95% confidence intervals indicate that our scoring system had good to very good inter-rater agreement. No adverse effect was recorded. Histological evaluation of biopsies collected from six dogs at D78 revealed no notable differences between both sides. These findings provide preliminary evidence of the potential efficacy of FLE for the treatment of Alopecia X and showcase the need for larger studies to better assess efficacy with standardized evaluation methods.

Source of funding: This work was supported in part by the Resident Research Grant from the Canadian Academy of Veterinary Dermatology. The photoconverter gel was kindly provided by Vetoquinol N.-A. Inc.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 12:00 PM

51: Comparison of fabric photoprotective clothing for reduction of ultraviolet (UVA and UVB) radiation

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Abstract: Shielding against solar ultraviolet (UV) radiation is essential in the prevention and management of actinic-related skin conditions, but there are currently no studies examining the efficacy of UV protective clothing for dogs. The aim of this study was to compare the efficacy of commercially available ultraviolet protection factor (UPF) and non-UPF fabric canine clothing in protecting against solar UV radiation (UVR). Three reclining fabric model dogs were used in this prospective controlled trial. A UV dosimeter was applied to each model on the right medial thigh. Two of the models had fabric clothing applied: (1) a UPF 50+ sunsuit (Full Cover Bodysuit, K9 TopCoat; Fresno, CA, USA); or (2) a cotton recovery suit (Dog Recovery Suit, Aokazi Pet Products; China). The control had no protective clothing applied. All models were placed in direct sunlight and measurements were taken every 15 min over a six-hour period on nine consecutive days. The total cumulative UVR was analyzed for each type of clothing or control. Both fabric clothing suits provided statistically significant UV protection compared to the control overall ($p<0.001$). The UPF suit was superior to the non-UPF suit for blocking cumulative UVR exposure over the nine-day period ($p<0.05$). Although the non-UPF suit offered some UVR protection, the UPF suit demonstrated superior performance in this study.

Source of funding: Self-funded.

Conflicts of interest: None declared

TUESDAY, APRIL 29, 2025 | 12:15 PM

48: Amphibians with dermatological lesions: a retrospective study of 223 cases at five university veterinary teaching hospitals (1986-2024)

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Abstract: Amphibian skin has unique structural and physiological properties making the organ sensitive to environmental alterations and cutaneous injuries. While many clinical signs and causes of skin disease have been described, no large-scale study has assessed the most common causes of dermatopathies or diagnostic tests used clinically in this taxa. This multi-institutional retrospective study reviewed the medical records of 223 anurans (frogs and toads) and urodeles (salamanders and newts) under human care with dermatologic lesions examined at five North American veterinary teaching hospitals. Anurans comprised 72.6% of the population and included representatives from 19 taxonomic families, while urodeles comprised 27.4% of the population with representatives from four taxonomic families. Ante-mortem diagnostic testing (complete blood count, serum biochemistry, fecal flotation, bacterial and/or fungal skin cultures, chytrid PCR, and/or histologic evaluation of biopsy tissues) was performed in 17% of patients, 63.7% had diagnostics exclusively performed post-mortem (necropsy with histologic evaluation of tissues, cultures collected post-mortem), 5.8% had pre- and postmortem diagnostics performed, and 13.5% had no diagnostics performed outside of an examination. Based on clinical findings and diagnostic test results, dermatologic diseases were categorized with the most common etiologies being infectious (45.3%; 101/223), undefined (22.9%; 51/223), and inflammatory (18.4%; 47/223). Infectious etiologies were further subdivided based on organism type; the most commonly identified types of infection were bacterial and chytridiomycosis. Dermatopathies are common in amphibians under human care, however, few amphibians receive an antemortem diagnostic workup, representing areas for improvement in the medical management of this taxa.

Source of funding: Self-funded.

Conflict of interest: None declared

TUESDAY, APRIL 29, 2025 | 2:00 PM

5: Effect of fluorescence photobiomodulation on canine progenitor epidermal keratinocytes with and without *Staphylococcus pseudintermedius* colonization

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Abstract: Fluorescence photobiomodulation (FPB) is a promising treatment for canine skin infections and wounds, but no studies have been published assessing its effect on canine keratinocytes *in vitro*. The primary objective was to determine the anti-inflammatory and antimicrobial effect of FPB on canine keratinocytes with and without colonization by *Staphylococcus pseudintermedius* (SP). A secondary objective was to determine the viability of canine keratinocytes with and without colonization by SP following exposure to FPB. Canine progenitor epidermal keratinocytes (CPEK) were grown in chamber slides. A subset of CPEKs were colonized with SP before FPB treatment. The CPEKs, with and without SP, were exposed to FPB for four minutes. The supernatant was collected at 0, 1, 6 and 24 hours post-FPB to evaluate cytokines (interleukin (IL)-2, IL-6, IL-7, IL-8, IL-10, IL-15, IL-18, tumor necrosis factor-α, interferon-γ, keratinocyte chemotactic-like, interferon-γ induced protein 10 (IP-10), granulocyte-macrophage colony-stimulating factor, and monocyte chemoattractant protein-1) and host defense peptides (cBD3-like and cCath) production. Cell cytotoxicity was assessed via lactate dehydrogenase and adenosine triphosphate assays. Experiments were performed in duplicate and repeated five times. A lack of cytotoxicity was observed post-FPB over a 24-hour period. At 6 hours post-FPB, IP-10 fluorescence intensity was significantly decreased in CPEK+SP (p=0.038). No other statistically significant differences were found for cytokine, CBD3-like, or cCath secretion. Fluorescence photobiomodulation had no effect on cell viability and may have a mild anti-inflammatory effect on CPEK cells colonized by SP *in vitro*. Additional studies in primary keratinocytes are needed to explore this further.

Source of funding: This work was sponsored by a grant from The American College of Veterinary Dermatology.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 2:15 PM

8*: In vitro* evaluation of the antimicrobial activity of chlorhexidine alone or in combination with ketoconazole or miconazole against clinical isolates of multidrug resistant *Staphylococcus pseudintermedius*

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Abstract: Multidrug resistant *Staphylococcus pseudintermedius (MDR-SP)* has become increasingly prevalent in cases of canine pyoderma. Chlorhexidine-based products have been utilized as a topical treatment of choice. Many of these products contain miconazole and ketoconazole. The study's aim was to assess the efficacy and potential additive and/or synergy between chlorhexidine and ketoconazole/miconazole against clinical isolates of *MDR-SP.* Broth microdilution was performed in duplicate on 30 clinical isolates of MDR-*SP* using six two-fold dilutions of chlorhexidine digluconate (12 µg/mL-0.375 µg/mL), miconazole nitrate (8 µg/mL-0.25 µg/mL), and ketoconazole (160 µg/mL-5 µg/mL), and eight two-fold dilutions of 1:1 combinations of the azoles with chlorhexidine. The minimum inhibitory concentration (MIC) and two dilutions above the MIC were plated to determine the minimum bactericidal concentration (MBC) of each compound and combination. The $MIC_{50/90}$ of chlorhexidine was 1.5 µg/mL. Both the chlorhexidine/miconazole (p=0.003) and chlorhexidine/ketoconazole (p<0.0001) combinations had lower MICs than chlorhexidine alone. Although no MIC was achieved with ketoconazole, the MIC_{50} and MIC_{90} for miconazole was 4 µg/mL. The MBC for azoles was not achieved. There was no difference between the $MBC_{50/90}$ of the chlorhexidine/miconazole combination (3/6 µg/mL; p=0.198) and chlorhexidine (3/6 µg/mL) alone. A lower $MBC_{50/90}$ was seen for chlorhexidine/ketoconazole (3/3 µg/mL; p=0.0071) and chlorhexidine alone. An additive or synergistic effect was only seen for a few isolates for ketoconazole (0/1)-miconazole (9/3)/chlorhexidine combination. Although an additive or synergistic effect was minimal, an azole/chlorhexidine combination could be more effective than chlorhexidine alone against *MDR-SP*. Further *in vitro* studies assessing the efficacy of azole/chlorhexidine products should be performed.

Source of funding: This work was supported by Virbac Inc.

Conflict of interest: DS has received research support and lecture honoraria from Virbac Inc.

TUESDAY, APRIL 29, 2025 | 2:30 PM

11: Effects of heavy metals as environmental factors in canine atopic dermatitis

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Abstract: Atopic dermatitis (AD) is a chronic inflammatory skin disease affecting both humans and animals. Canine atopic dermatitis (CAD) shares clinical and immunopathological similarities with human AD, making it a useful model for one health research. While indoor air pollution is recognized as a factor in AD, the role of heavy metal exposure, particularly through particulate matter (PM) in CAD, remains unclear. This study explored the relationship between PM-related heavy metals and CAD severity. Hair samples from 77 CAD dogs and 50 control dogs were analyzed for eight heavy metals, and indoor $PM_{2.5}$ levels were monitored. CAD severity was assessed using Canine Atopic Dermatitis and Severity Index-04 (CADESI-04), Pruritus Visual Analog Scale (PVAS), and Transepidermal Water Loss (TEWL) with immunoglobulin E (IgE) and interleukin-4 (IL-4) levels measured to evaluate immune response. Mercury (r =0.8691, p<0.001), lead (r =0.8248, p<0.001), and nickel (r =0.7583, p<0.001) were significantly correlated with indoor $PM_{2.5}$ levels and CAD severity. CADESI-04 (Mercury; r =0.4075, p=0.0206, Lead; r =0.4336, p=0.0132, Nickel; r =0.4075, p=0.0206) and TEWL (Mercury; r =0.5428, p=0.0013, Lead; r =0.6037, p=0.0003, Nickel; r =0.5428, p=0.0013) showed strong correlations with these metals, while PVAS was correlated with all metals except mercury. Dogs with higher metal exposure showed increased IgE levels, with IL-4 positively associated with mercury and nickel, suggesting metals exacerbate CAD by Th2-mediated immune responses. The study emphasizes addressing heavy metal exposure in CAD, highlighting dogs as indicators and advocating mitigation through disposal and safer alternatives.

Source of funding: This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF), funded by the Ministry of Education (NRF- 2023R1A2C1005348) and Korea Institute of Planning and Evaluation for Technology in Food, Agriculture and Forestry (IPET) through Agriculture and Food Convergence Technologies Program for Research Manpower development funded by Ministry of Agriculture, Food and Rural Affairs (MAFRA) (grant number: RS-2024-00398561).

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 2:45 PM

13: Comparison of intradermal allergy testing with and without fluorescein and serum allergy testing in 10 cats with feline atopic skin syndrome

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Abstract: The correlation between intradermal allergy testing (IDAT) and serum allergy testing (SAT) in cats with feline atopic skin syndrome (FASS) is poorly investigated. The first objective of this study was to test the hypothesis that the use of intravenous fluorescein during IDAT in cats with FASS may increase visibility and readability of positive reactions and thus improve inter-observer agreement. The second objective was to investigate the agreement of IDAT and SAT results. Ten privately owned cats with non-seasonal FASS underwent IDAT with 31 allergens (Stallergens Greer, Lenoir, NC, USA) under sedation. Test results were documented 15- and 30-min post injection by two independent investigators. Fluorescein (AK-FLUOR 10%, Akorn; Lake Forest, IL, USA) was injected intravenously at 5mg/kg after the 15 min result documentation and reactions were read under ultraviolet light. Serum for allergen-specific IgE testing (IDEXX Laboratories, Westbrook, ME, USA) was obtained prior to IDAT. Cohen's kappa coefficient statistics with 95% confidence interval evaluating interobserver agreement of IDAT reactions improved from good (kappa=0.61) to excellent (kappa=0.76) after intravenous fluorescein was added. Agreement between IDAT and SAT results was poor regardless of investigator and absence or presence of fluorescein (kappa range 0.18-0.26). In conclusion, intravenous fluorescein enhances IDAT interpretation in cats with FASS. Poor agreement exists between IDAT and SAT results in cats with FASS which may have clinical ramifications as allergen selection for allergen specific immunotherapy formulations may vary drastically based on the chosen allergy test.

Source of funding: Clinical Research Committee, Department of Small Animal Medicine and Surgery, College of Veterinary Medicine, University of Georgia, Athens, GA, USA.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 3:00 PM

16: Characterization of a monoclonal antibody against equine IL-31

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Abstract: IL-31 mediates pruritus in horses and plays a key role in insect bite hypersensitivity (IBH). We produced monoclonal antibodies (mAbs) against recombinant equine IL-31 protein. Three mAbs were selected based on their strong binding affinity and low dissociation rate, with one chosen for further characterization. Three horses with IBH were selected for the study. Diagnosis was based on history, clinical signs, and positive intradermal test with *Culicoides* allergen. Blood samples were taken and adherent monocytes were isolated. Cells were incubated with varying doses of recombinant equine IL-31 protein, *Culicoides* allergen, and the monoclonal antibody. We measured the ratio of phosphorylated signal transducer and activator of transcription 3 (pSTAT3) to total STAT3 (tSTAT3) using AlphaLISA (Revvity Health Sciences, Waltham, MA, USA). An increased pSTAT3/tSTAT3 ratio indicates JAK/STAT activation and IL-31 activity, while a decreased ratio suggests inhibition. Paired t- test was used to analyze data. We found that the lowest concentration of recombinant IL-31 protein that caused a statistically significant increase in the pSTAT3/tSTAT3 ratio compared to unstimulated cells was 0.1 µg/mL ($p<0.00001$). Furthermore, a 10:1 (mAb:recombinant) ratio significantly suppressed the pSTAT3/total STAT3 ($p<0.01$). Significant suppression also occurred when the mAb was incubated for 2h prior to adding the *Culicoides* allergen ($p=0.0017$). This finding is very promising, as some activation of pSTAT3 may still occur due to the release of other cytokines, besides IL-31, from the *Culicoides* allergen. We conclude that this monoclonal antibody is a viable candidate for future equinization with the intent to be used as a biologic treatment for IBH.

Source of funding: The American College of Veterinary Dermatology. This work was supported in part by the A.H. Burnett Equine Studies Endowment Fund and Stephen J. Flynn, Jr., and Dorothy B. Flynn Memorial Equine Disease Research Fund from the University of Florida Foundation.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 3:15 PM

17: In situ hybridization for the identification of mammalian pathogenic oomycetes in formalin-fixed and paraffin-embedded specimens

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Abstract: *Pythium insidiosum*, *Lagenidium giganteum* forma *caninum*, and *Paralagenidium karlingii* are frequently associated with severe and progressive infection in the skin of dogs, cats and horses. Timely and rapid diagnosis is important to predict lesion progression and select appropriate treatment. PCR enables relatively rapid and accurate differentiation of oomycete genera but low quality of DNA in formalin-fixed, paraffin-embedded (FFPE) tissue negatively affects PCR performance. Mitigating this, we aimed to optimize chromogenic in situ hybridization (CISH) using RNA probes targeting exo-1,3-β-glucanase gene (*P. insidiosum*), β tubulin (*L. giganteum* f *caninum*), and HSP90 and myosin like-gene (*P. karlingii)*. CISH was conducted on FFPE skin sections with PCR confirmed oomycosis. A strong hybridization signal of *L. giganteum* f *caninum* and *P. karlingii* was detected in infected tissues; conversely, when tested across genera, these probes exhibited moderate to strong cross-reactivity. Signal was not detected with the *P. insidiosum* probe due to the low copy nature of targeted gene. Probe specificity also was ensured by testing cross-hybridization with common fungal pathogens, which were all negative. Our results demonstrate that CISH can potentially be an effective method to diagnose oomycetes in FFPE alternatively to PCR. However, cross-reactivity indicates low specificity of the selected probes to distinguish oomycete genera, presumably due to the high degree of homology throughout the designated target genes in the oomycetes. As future directions, refine gene selection for probe design might address this challenge, improving accuracy and allowing multiplex CISH optimization, enhancing test efficacy and reducing turnaround time for oomycete diagnosis in FFPE specimens.

Source of funding: This work was supported by the International Society of Veterinary Dermatopathology (ISVD).

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 3:30 PM

18: The bacteriome and mycobiome of the bearded dragon (*Pogona vitticeps*) across cloacal, oral, and cutaneous sites using Next-Generation Sequencing

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Abstract: Despite their popularity, the microbiome of bearded dragons (*Pogona vitticeps*) has not been described. This study aimed to establish clinically relevant diagnostic reference ranges for the cutaneous, oral, and cloacal bacteriome and mycobiome of healthy (n=20) and infected (n=10) bearded dragons (i.e., dermatitis, leukemia, hyperparathyroidism). Infected bearded dragons identified based on physical examination. The microbiome was processed, sequenced, and analyzed via next-generation sequencing (NGS) (MiDOG Animal Diagnostics LLC; Tustin, CA). Bacterial and fungal DNA was amplified using the 16S rRNA V1-3 and ITS-2 genes, respectively. Alpha and beta diversity, number of observed species, and absolute cell counts were compared (Kruskal-Wallis test with Bonferroni post hoc correction). Specific bacterial and fungal taxa per group were analyzed (Linear Discriminant Analysis Effect Size). The cutaneous bacteriome ($p<0.0001$) and mycobiome ($p<0.0001$) were more diverse than the oral or cloacal sites. There were significant differences in the observed bacterial species between healthy and unhealthy oral ($p=0.004$) and cutaneous ($p<0.0001$) groups. The bacteriome was dominated by the Actinobacteria, Proteobacteria, and Firmicutes phyla, particularly *Salmonella enterica* in the cloaca, an unidentified *Pseudomonas* sp. in the oral group, and an unidentified *Clostridium* sp. in the cutaneous group. Six bacterial species comprised the core bacteriome shared between sites. The mycobiome was dominated by the Ascomycota phylum, with one species, *Hyphopichia burtonii,* comprising the core mycobiome. These findings can aid clinicians in the interpretation and implementation of NGS results for pathogen diagnosis in bearded dragons, enhance the understanding of disease risk, and inform preventive measures against zoonotic transmission.

Source of funding: University of Illinois, College of Veterinary Medicine.

Conflict of interest: K. Zapanta and J. Krumbeck are employees of MiDOG Animal Diagnostics and K. Keller works on a consultancy basis for MiDOG Animal Diagnostics.

TUESDAY, APRIL 29, 2025 | 3:45 PM

27: Infectious diseases in dermatology – A comparative analysis shows major differences in research priorities

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Abstract: The skin, as the body's largest organ, plays a major role in the immune defense, but can itself be the target of various types of infections or infestations. Bacteria, funguses, parasites, and viruses can affect the skin either as primary target or as part of systemic infections. The skin may also play an important role in disease transmission within and between species (zoonoses). The study goal was thus to determine how the roles and research into infectious diseases compares between humans and animals. We compared the research dedicated to infectious diseases in human and animal dermatology by analyzing the publications in the respective field's leading journals, namely the Journal of the American Medical Association *JAMA Dermatology* and *Veterinary Dermatology*. Between 1990 and October 2024 *JAMA Dermatology* published 11,663 of which approximately 5% concerned infectious diseases while *Veterinary Dermatology* published 2,111 articles with more than 35% of them on infectious diseases. The most researched causative agents in human dermatology were herpesviruses, papillomaviruses, and human immunodeficiency viruses with approximately 1% of the total publications each; less than 0.05% were on methicillin-resistant *Staphylococcus aureus* (MRSA). In the veterinary field the most researched agents were staphylococci (10%; including 1% MRSA), dermatophytes (4%), malassezia (4%), fleas (3%), demodex (3%), and papillomaviruses (3%). The results show major differences in the research efforts on infectious diseases in human and veterinary dermatology, indicating a different importance. The reasons are likely manifold including physiological, ecological, and economical ones but may be important to consider in a One Health context.

Source of funding: This work was supported by a Kwantlen Polytechnic University Student Research and Innovation Grant.

Conflict of interest: None declared

TUESDAY, APRIL 29, 2025 | 4:30 PM

6: Results of a clinical study evaluating the efficacy and safety of chewable oclacitinib tablets for the control of pruritus associated with allergic dermatitis in dogs

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Abstract: Two hundred and eleven dogs were randomized (1:1) into one of two treatment groups: placebo (n=107) or chewable oclacitinib (Apoquel Chewable®, Zoetis; Parsippany-Troy Hills, NJ, USA) (n=104) in a field study evaluating the efficacy and safety of chewable oclacitinib administered twice daily (0.4-0.6 mg/kg, per os). The primary efficacy endpoint for treatment success (Yes/No) was defined as at least a 50% decline in the Pruritus Visual Analog Scale (pVAS) on at least 5 of 7 of the Day 1-7 pVAS scores compared to baseline. Dogs withdrawn for lack of efficacy were counted as treatment failures starting on the day of withdrawal. A significantly greater proportion of chewable oclacitinib-treated dogs (30.0%) achieved treatment success versus placebo (5.0%) (p=0.0008). A significant difference was present for both the pVAS as well as the percent change in pVAS from baseline for each day evaluated (p<0.0001 on Days 1-7 for the least square mean of both measures). An Examining Veterinarian Dermatitis Visual Analog Score assessed on Day 0 and at the final visit had a significantly lower dermatitis score at study completion (p<0.0001) and a significantly greater (p=0.0006) percent decrease from baseline for the chewable oclacitinib (-61.1%) group compared to placebo (-27.3%). Adverse events were considered typical and occurred at a similar frequency in both groups. Clinical pathology showed no effects that appeared clinically significant or biologically important. These results demonstrated the effectiveness and safety of chewable oclacitinib administered twice daily for 7 days to dogs for the treatment of clinical signs of allergic dermatitis.

Source of funding: Zoetis.

Conflict of interest: The author is employed by Zoetis.

TUESDAY, APRIL 29, 2025 | 4:45 PM

21: Evaluation of antibody levels and clinical response to transdermal immunotherapy in six dogs: a pilot study

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Abstract: This pilot study evaluated the immunologic and clinical response of dogs with atopic dermatitis to a transdermal immunotherapy cream (Allibre; Austin, TX, USA) containing dust mite (*Dermatophagoides farinae)*, ragweed (*Ambrosia artemisiifolia*), and timothy grass (*Phleum pratense)* allergens. Six dogs with elevated allergen-specific IgE levels to these allergens completed the study. Serum IgE and IgG levels and Canine Atopic Dermatitis Extent and Severity Index (CADESI)-4 scores were measured at baseline and after one, three, and six months of treatment. Analysis of immunoglobulin changes was performed using repeated measures ANOVA and Tukey's HSD test for pairwise comparisons. A linear mixed effects model as a function of months for each patient was used to evaluate changes in CADESI-4. Results demonstrated a statistically significant reduction in IgE levels for all allergens tested; IgG levels remained unchanged. *D. farinae* IgE levels decreased by 68% (2292 EAU to 732 EAU), ragweed IgE levels decreased by 43.5% (200 EAU to 113 EAU), and timothy grass IgE levels decreased by 53.8% (195 EAU to 90 EAU). All reductions were statistically significant ($p<0.001$). ANOVA results confirmed significant differences in IgE levels over time ($p=0.0015$), and pairwise comparisons using Tukey's HSD supported these findings for each allergen. Month did have a significant effect on CADESI-4 which changed by an estimated -2.42 per month (95% CI [-3.27, -1.58]). Transdermal immunotherapy reduced IgE levels and improved the severity of lesions in dogs with atopic dermatitis. Further research with larger sample sizes and extended treatment periods is warranted to assess the long-term immunologic and clinical benefits of this novel therapy.

Source of funding: This work was supported by Animal Dermatology Group, Allibre, and Stallergenes Greer.

Conflict of interest: Authors from Animal Dermatology Group have financial investment in Allibre.

TUESDAY, APRIL 29, 2025 | 5:00 PM

14: The role of comorbidities in pyoderma among canine and feline diabetic patients: beyond diabetes

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*College of Veterinary Medicine, Iowa State University, Ames, IA, USA
†College of Veterinary Medicine, Colorado State University, Fort Collins, CO, USA

Abstract: Studies in human medicine have identified pyoderma as a secondary complication in patients with diabetes mellitus (DM), a claim that has faced skepticism in veterinary contexts. Previous research indicated that 22% of dogs with DM presenting for dermatologic disorders had no concurrent comorbidities. Additionally, there has been no comparable investigation in cats to date. This study seeks to identify comorbidities in dogs and cats with DM developing pyoderma. Our multi-institutional retrospective study analyzed the medical records of canine and feline patients diagnosed with DM between August 1, 2019, and November 18, 2022, at Iowa State University and Colorado State University. We further examined cytologically confirmed cases of pyoderma and assessed the prevalence of underlying conditions such as allergies, thyroid disease, adrenal disease, neoplasia and other miscellaneous dermatological disorders. Among the 51 dogs analyzed, only one was free of identifiable underlying conditions (2.0%) while allergic dermatitis was the most common comorbidity at 72.5% in dogs. Of the 14 cats reviewed, one (7.1%) had no associated conditions. Cats presented with allergic dermatitis (71.4%) most frequently, while the others had several concurrent disorders. Although sex distribution was consistent across species, certain breeds, notably English and Irish setters, showed a higher occurrence of pyoderma compared to the general population of DM cases without pyoderma. Overall, this suggests that pyoderma in these diabetic patients is due to coexisting conditions rather than DM, highlighting the importance of identifying and treating concurrent diseases to manage pyoderma effectively.

Source of funding: Self-funded.

Conflict of interest: None declared.

TUESDAY, APRIL 29, 2025 | 5:15 PM

19: Treatment of canine pemphigus variants with oclacitinib: a retrospective analysis of 20 cases

B.L. SCRANTON *, C.A. OUTERBRIDGE†, A.T.H. LAM†, L. TOMICH*, V.K.A. AFFOLTER‡
**Small Animal Dermatology, UW Vet Care, Madison, WI, USA*
†Department of Medicine and Epidemiology, School of Veterinary Medicine, University of California, Davis, California 95616, USA.
‡Department of Pathology, Microbiology, Immunology, School of Veterinary Medicine, University California Davis, Davis, CA, 95616, USA

Abstract: This multicenter retrospective study evaluated the efficacy of oclacitinib (Apoquel®, Zoetis; Parsippany-Troy Hills, NJ, USA) and its potential to reduce corticosteroid use in dogs with pemphigus variants. Medical records from UC Davis VMTH and UW Vet Care were reviewed for dogs diagnosed with pemphigus variants via histopathology and prescribed oclacitinib between 2013 and 2024. Twenty dogs with at least two months follow-up were identified. Oclacitinib alone was effective in 50% (10/20) of dogs at a median dose of 0.65 mg/kg/day *per os* (p.o.) (range 0.24-1.9 mg/kg/day p.o). Seven of these ten dogs reached full remission, with a median time to remission of three months after starting oclacitinib (range 1-15 months). Three reached partial remission, with a median time of two months after starting oclacitinib (range 2-10 months). Oclacitinib was utilized as an adjunctive therapy in 35% (7/20) of dogs at a median dose of 1.1 mg/kg/day p.o. (range 0.4-2.4 mg/kg/day p.o.). Six had improvement after the addition of oclacitinib, and these patients remained in partial remission. One patient relapsed and was transitioned to cyclosporine. Oclacitinib was ineffective in 15% (3/20) of dogs, at a median dose of 1.0 mg/kg/day p.o. (range 0.9-1.2 mg/kg/day p.o.). Two of these patients were switched to other therapies including methylprednisolone, azathioprine, and triamcinolone while one dog died from sepsis while on cyclosporine and prednisone. Adverse effects from the oclacitinib were not reported and follow-up blood work was not consistently performed. Oclacitinib can be considered an effective treatment option in a subset of pemphigus cases.

Conflict of interest: None declared.

Source of funding: Self-funded.

PRESENTATION SCHEDULE

WEDNESDAY APRIL 30, 2025

SCIENTIFIC NOTES | LOCATION: WINDERMERE BALLROOM W

09:00 - 09:50	Dr. Amanda Cox	**Food Allergies in Humans Part 1 – Clinical Presentations and Diagnostic Testing**
10:00 - 10:50	Dr. Amanda Cox	**Food Allergies in Humans Part 2 – Current and Emerging Therapeutics**
11:30 - 12:20	Dr. Deborah Linder	**Diet Dilemmas: Interactive Cases with Multiple Diseases**
14:00 - 14:50	Dr. Deborah Linder	**Making Client Communication Easier: Nutrition Mythbusting and Pet Food FAQs**
15:00 - 15:50	Dr. Galia Sheinberg	**Changing Perspectives in Food Allergy: Are we Cracking the Code?**
16:30 - 17:20	Dr. Galia Sheinberg, Dr. Deborah Linder & Dr. Kenneth Simpson	**Panel Discussion: Food Allergies**

CLINICAL NOTES | LOCATION: WINDERMERE BALLROOM X

09:00 - 09:50	Dr. Agustina Anson & Dr. Ramon Almela	**Radiology Meets Dermatology: A Collaborative Approach**
10:00 - 10:50	Dr. Agustina Anson & Dr. Ramon Almela	**Radiology's Role in Veterinary Dermatology**
11:30 - 12:20	Dr. Dana Connell	**What if it is Lymphoma?**
14:00 - 14:50	Dr. Dana Connell	**What if it is NOT Lymphoma?**
15:00 - 15:50	Dr. Jeanine Kennedy	**Dermatopathology for Clinical Dermatologists - Part 1**
16:30 - 17:20	Dr. Jeanine Kennedy	**Dermatopathology for Clinical Dermatologists - Part 2**

PRESENTATION SCHEDULE

EMERGING NOTES | LOCATION: REGENCY BALLROOM T

09:00 - 09:50	Dr. Neoklis Apostolopoulos	**Artificial Intelligence in Veterinary Medicine: Fundamentals and Advances - Part 1**
10:00 - 10:50	Dr. Neoklis Apostolopoulos	**Artificial Intelligence in Veterinary Medicine: Fundamentals and Advances - Part 2**
11:30 - 12:20	Dr. Millie Rosales	**The Future of Veterinary Medicine in a Multicultural World**
14:00 - 14:50	Dr. Alberto Martin Cordero, Dr. Andrea Hernandez-Bures, Dr. Valerie Fadok & Dr. Millie Rosales	**Panel Discussion: How to Practice in a Multi-national World**
15:00 - 15:50	Dr. Zachary Meyers	**PendingGPT for DVM: How Language Models are Transforming Veterinary Medicine**
16:30 - 17:20	Dr. Zachary Meyers	**AI in Your Practice: Getting Started with LLMs**

ADVT NOTES | LOCATION: REGENCY BALLROOM V

09:00 - 09:50	Dr. Paul Bloom	**Diagnostic Testing in Dermatology DVM Tech**
10:00 - 10:50	Dr. Galia Sheinberg	**Facilitating Food Allergy Diagnosis: A Guide for Veterinary Technicians**
11:30 - 12:20	Dr. Flávia Clare	**Fungal Diseases for Vet Techs**
14:00 - 14:50	Dr. Tricia Sowers	**Climate Change and Allergic Disease**
15:00 - 15:50	Mrs. Jennie Tait	**Engaging and Empowering Veterinary Technicians in Veterinary Dermatology - Interactive Session**
16:30 - 17:20	Dr. Agustina Anson & Dr. Ramon Almela	**Radiology for Veterinary Technicians**

WEDNESDAY, APRIL 30, 2025 | 09:00 AM

Food Allergy in Humans Part 1 – Classification and Diagnosis of Food Allergic Disorders

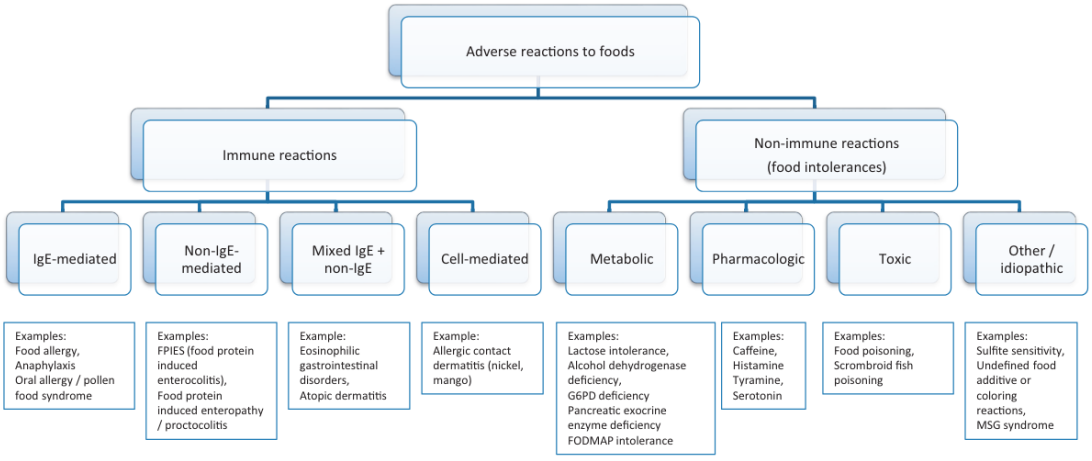
AMANDA L COX, ASSOCIATE PROFESSOR OF PEDIATRICS

Department of Pediatrics, Division of Pediatric Allergy, Jaffe Food Allergy Institute
Icahn School of Medicine at Mount Sinai, New York, NY, USA

Classification of Adverse Reactions to foods

Foods can induce adverse reactions in humans by a variety of mechanisms. Reactions to foods can be broadly considered in the categories of "non-immunologic" and "immunologic," terms based on the pathophysiology that results in characteristic symptoms. Food intolerance, or non-immunologic reactions, result from inability to metabolize a component of a food, or due to toxic effects or pharmacologic properties of a food. What we consider "food allergy" generally involves immune responses to a food. Food allergies may further be categorized based on the effector elements of the human immune system that are activated following exposure to a food: Immunoglobulin E (IGE)-mediated, non-IgE mediated or cell-mediated. Some chronic allergic responses involve a combination of immune mechanisms. An understanding of the characteristic signs and symptoms and related mechanisms of adverse food reactions allows clinicians to more efficiently recognize the etiology of reactions as well as diagnose food allergic conditions / disorders in human patients.

Below is a schematic of the classification of adverse food reactions:

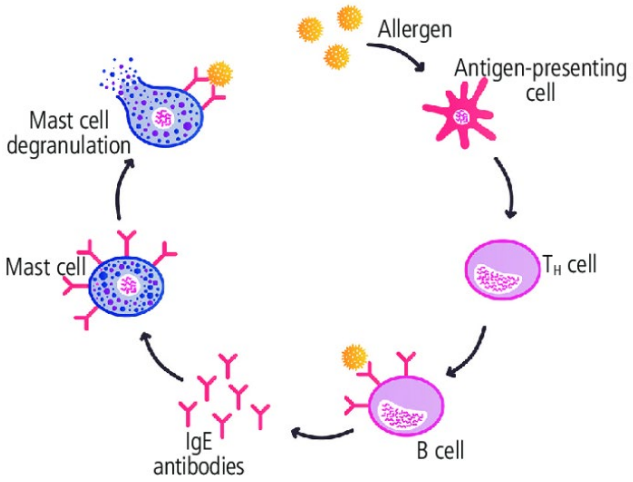


Cox AL, Sicherer SH. Classification of adverse food reactions. J Food Allergy. 2020 Sep 1;2(1):3-6.

The most common non-immune metabolic food intolerance is lactose intolerance, in which the small intestine lacks or is deficient in lactase enzyme needed to digest lactose, leading to symptoms of bloating, abdominal pain, loose stools. Lactose intolerance affects 70% of adults, and is rare but does occur in children. Other non-immune adverse food reactions include pharmacologic effects of foods or food ingredients, such as caffeine, toxic effects of foods. There are additional non-immune reactions to foods which fall into the category of "idiopathic" food intolerances.

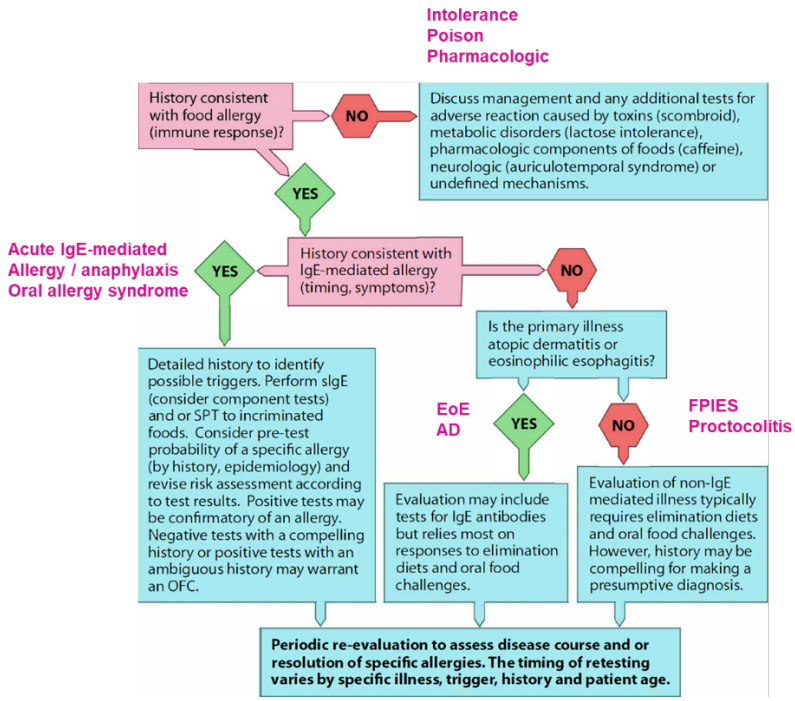
Immune mediated reactions include IgE mediated (food allergy, anaphylaxis, oral allergy / pollen-food syndrome), non-IgE mediated reactions (food protein induce enterocolitis, enteropathy and proctocolitis, celiac disease), mixed IgE + non IgE reactions (eosinophilic GI disorders, atopic dermatitis), and cell mediated reactions (allergic contact dermatitis).

Mechanism of allergic inflammation in type I hypersensitivity reactions:



González de Olano, David & Alvarez-Twose, Iván. (2018). Mast Cells as Key Players in Allergy and Inflammation. Journal of Investigational Allergology and Clinical Immunology. 28. 365-378. 10.18176/jiaci.0327.

Diagnosis of Food Allergy



Sicherer SH, Sampson HA. Food allergy: A review and update on epidemiology, pathogenesis, diagnosis, prevention, and management. J Allergy Clin Immunol. 2018;141(1):41-58

Diagnosis of food allergy requires a careful and detailed allergy-focused clinical history. Included in a clinical history should be the description of symptoms of reaction, food and amount ingested, and any treatments required. The timing of onset of symptoms related to the exposure is also key. The clinical history guides the use of allergy testing and affects the interpretation of test results, and tests that are ordered should be based on the history and pathophysiology of the suspected food allergic disorder.

The current diagnostic tests that are in our armamentarium include skin prick testing to allergenic extracts, skin prick testing to fresh food, serum specific IgE to allergen extracts, serum specific IgE to individual allergenic components, and observed oral food challenges. In skin prick testing, wheal size (in mm) reflects the amount of mast cell mediators after stimulation with antigen. The concentration of IgE in the serum, measured by enzyme-linked immunosorbent assays (ELISA), also reflects the amount of circulating IgE antibodies directed at a specific allergy or allergen component. In general, food specific IgE antibody concentrations and skin test wheal diameters correlate with risk of clinical reactivity, however predictive values vary by food, by age, and by clinical history.

Potent components that are highly predictive of true clinical allergy have been identified for several foods, including peanut (Ara h 2, Ara h 6), Egg (ovomucoid), walnut (Jug r1),

cashew (Ana O3), Milk (casein), and hazelnut (Cor a 8, Cor a 9, Cor a 14). As a result, molecular diagnostic serum IgE assays are now widely used in practice. It is important to recognize however that all of the above tests have a range and are not simply positive or negative. Furthermore, testing is not often predictive of food allergy severity or threshold. Moreover, it is possible to elicit positive testing (or demonstrate IgE sensitization) to food to which there is no clinically relevant allergy. The selection of diagnostic testing and interpretation of results requires

When clinical history and skin and serum IgE diagnostic testing are not conclusive, an allergy specialist may perform an oral food challenge (OFC) in a clinical setting. An oral food challenge can be double-blinded (the gold standard for clinical research), single-blinded, or open. In an oral food challenge a patient is fed the food in question in dose increments at 15-30 minute intervals until a full serving has been ingested. The patient is observed during feeding and for 1-2 hours after feeding for signs or symptoms of an allergic reaction. An OFC is considered "negative" if a patient does not react, and "positive" if they do have an allergic reaction. Performing an OFC requires facility and staff who are trained to recognize and prepared to treat any severity of allergic reaction.

Additional diagnostic modalities are being investigated for their utility in diagnosing IgE-mediated food allergy and predicting OFC outcomes. Clinical trials for peanut allergy and therapeutics have shown promise for the basophil activation testing (BAT) to predict the severity of allergic reactions, and epitope mapping for predicting the threshold amount of peanut that may be tolerated as well as persistence of peanut allergy. There are several additional diagnostic modalities in development, which we hope may improve our ability to determine prognosis, severity, threshold tolerated, and response to therapies for food allergy.

References:

Cox AL, Sicherer SH. Classification of adverse food reactions. J Food Allergy. 2020 Sep 1;2(1):3-6.

Sicherer SH, Sampson HA. Food allergy: A review and update on epidemiology, pathogenesis, diagnosis, prevention, and management. J Allergy Clin Immunol. 2018 Jan;141(1):41-58

Foong RX, Dantzer JA, Wood RA, Santos AF. Improving Diagnostic Accuracy in Food Allergy. J Allergy Clin Immunol Pract. 2021 Jan;9(1):71-80.

Sampson HA, Arasi S, Bahnson HT, et al. AAAAI-EAACI PRACTALL: Standardizing oral food challenges-2024 Update. Pediatr Allergy Immunol. 2024 Nov;35(11):e14276

WEDNESDAY, APRIL 30, 2025 | 10:00 AM

Food Allergy in Humans Part 2 – Prevention and Treatment of Food Allergic Disorders

AMANDA L COX, ASSOCIATE PROFESSOR OF PEDIATRICS
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Prevention of food allergy

Food allergy is a growing health condition affecting 8% of children and 11% of adults in the United States. There has been keen interest in understanding the cause(s) of food allergy and determining whether there are ways to prevent food allergy, particularly from developing in infants and children. Research has examined the prenatal period, birth, and early infant/childhood exposures for clues and potential means of intervening. Areas of interest have included maternal prenatal diet, mode of birth/delivery, breastfeeding and duration of breastfeeding, formula selection and early infant diet, supplementation with probiotics, maternal and infant microbiome, and infant/child eczema and skin care. Studies of the timing of complementary food introduction for infants have proven the most impactful in this last decade.

The Learning Early About Peanut (LEAP) Allergy trial, published in 2015, demonstrated that in infants at high risk of allergy, early peanut introduction in the first 11 months of life resulted in significant (81%) reduction in peanut allergy prevalence at 5 years of age. High risk was defined as young infants with egg allergy and/or severe eczema. This led to US, Canadian, and European guideline changes recommending early introduction of peanut (between 4-6 months) into the diets of infants in those high risk categories.

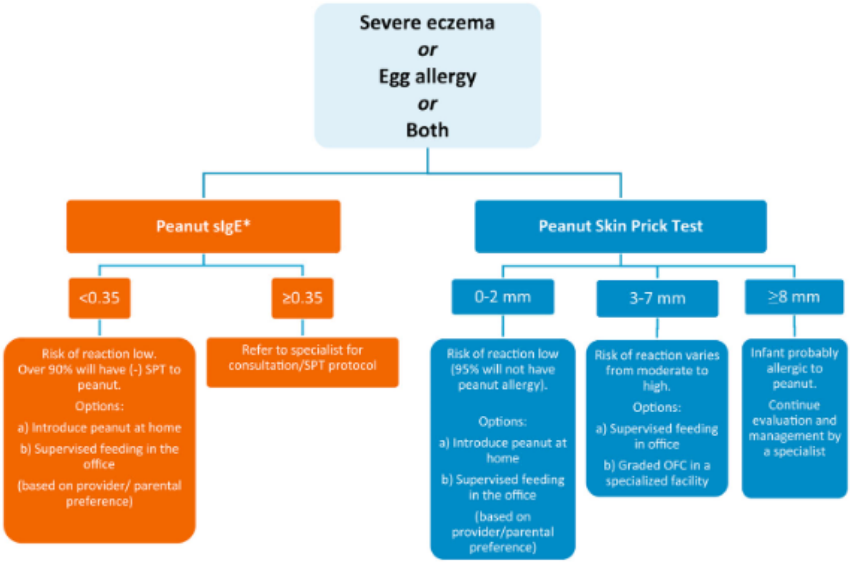
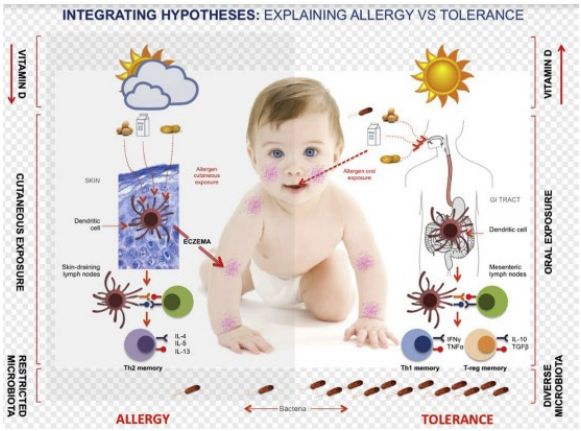


Fig. 1 Recommended approaches for evaluation of children with severe eczema and/or egg allergy before peanut introduction. *To minimize a delay in peanut introduction for children who may test negative, testing for peanut-specific Ige may be the preferred initial approach in certain health care settings. Food allergen panel testing or the addition of sIgE testing for foods other than peanut is not recommended due to poor positive predictive value

Togias A, Cooper SF, et al. Addendum Guidelines for the Prevention of Peanut Allergy in the United States: Report of the National Institute of Allergy and Infectious Diseases-Sponsored Expert Panel.

Additional studies have shown with moderate certainty that egg introduction at 4 to 6 months is also associated with reduced egg allergy, although more data is needed before early egg introduction to infants is adopted as a guideline for primary prevention of egg allergy. The Enquiring About Tolerance (EAT) Trial did not find similar significant benefits to the early introduction of milk, sesame, fish or wheat.

The dual-allergen exposure hypothesis suggests that allergic food sensitization occurs through low-dose cutaneous exposures, whereas oral consumption induces tolerance. This is supported by the fact that infants with severe eczema are at highest risk for the development of food allergy, likely due to impaired skin barrier and the presentation of allergens via inflamed (eczematous) skin. Studies have been performed and are ongoing to determine if the enhancement of the skin barrier (via emollient application in early infancy) may prevent eczema or food allergies, but results are not yet conclusive.



DuToit et al Food allergy: Update on prevention and tolerance. J Allergy Clin Immunol. 2018

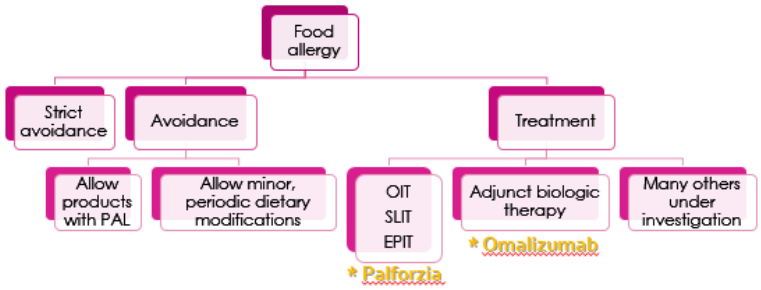
Dietary evaluation and interventions have also been proposed and studied. Findings have suggested that maternal diet diversity in pregnancy may be associated with reduced odds of allergic rhinitis, atopic dermatitis, asthma, and wheezing infants. Increased diet diversity during the first year of life is associated with decreased food allergy in the first 10 years of life. With regard to breastfeeding and formula selection, there is insufficient evidence that exclusive breastfeeding or hypoallergenic infant formulas have any benefit with regard to food allergy. Furthermore, prenatal and perinatal maternal and infant supplements (vitamin D, probiotics) so far show no clear role in preventing food allergy, although additional studies are ongoing.

The microbiome has become an area of increased interest with regard to how it may impact the development of many allergic and autoimmune disorders. With regard to food allergy, background studies have shown that C-section delivered infants are at higher risk for developing food allergy, and the hypothesis is that this may be due to lack of exposure to the vaginal bacteria (and different microbial diversity) to which vaginally delivered infants are exposed. The ACTIVATE study, currently ongoing at Mount Sinai, seeks to determine if C-section-delivered infants who are exposed to the vaginal microbiome (via swabbing infants with gaze on mouth, face, trunk) demonstrate food allergy sensitization at 12 months of age. Another nationwide, multi-center birth cohort study (SUNBEAM) is evaluating pre-natal and early life determinants of several allergic diseases, including food allergy and eczema, and will follow children until 3 years of age. We hope to determine what clinical, environmental, biological, genetic and other early life factors may impact the development of food allergy, so that we may have further areas for food allergy prevention and intervention.

Therapeutics and Management options for Food Allergy

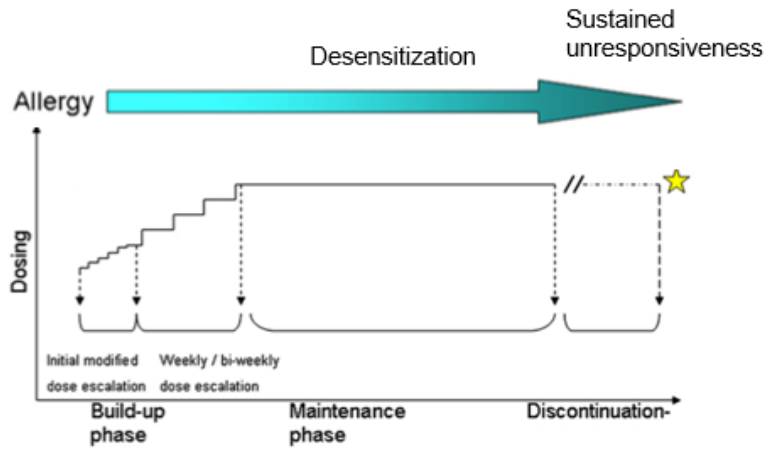
Until recently, the only management options for individuals with mediated food allergy were complete avoidance and prescription of self-injectable epinephrine. While infants and toddlers with milk and egg allergy are highly likely to naturally outgrow their food

allergies, the vast majority with true or proven IgE-mediated food allergy are unlikely to experience resolution. There is a great demand for safe and effective therapies to reduce the risk of anaphylaxis and other comorbidities, and to improve the lives of those living with food allergy. Fortunately there are several modalities on the horizon.



Sicherer SH et al. JACI Pract 2022;10:46-55.

Oral immunotherapy (OIT) may be the most significant change in clinical care for food allergy. While there have been many promising clinical trials, research is still needed to improve the efficacy, safety, tolerability and accessibility of OIT. OIT involves oral exposure to a starting very small (sub-threshold) amount of an allergenic foods, with daily ingestion, and dose-escalation or build-up phase (typically 4 to 6 months or longer) until a patient reaches a maintenance dose, which is continued for months or years. Desensitization is defined as a temporary increase in the threshold for reactivity and requires continued exposure. Sustained unresponsiveness is defined as a persistent lack of reactivity to the food after a period of avoidance.



Modified form Nowak A, J Allergy Clin Immunology 2011

Numerous controlled clinical trials of OIT have demonstrated that desensitization to a food is achievable in most, and that sustained unresponsiveness can be achieved in many. Achieving desensitization is impactful as it decreases the chance of a severe allergic reaction to food due to an accidental exposure. Complete tolerance (or "cure") is less likely, and is not an outcome that can be measured in clinical trials. Milk, egg, peanut and wheat OIT have been the best studied, while there are limited studies of other major food allergens.

In January, 2020, after the publication of several clinical trials demonstrating the efficacy of OIT for peanut allergic children, the FDA approved the first food allergy treatment, Palforzia, which is a peanut OIT product approved for children 4-17 years of age with confirmed diagnosis of peanut allergy. In January 2025, Palforzia was also approved for 1-3 year old children. Palforzia is manufactured as capsules with set peanut protein dosages, and is administered under the close supervision of allergists.

Additional promising immunotherapy treatment modalities under investigation and likely to be approved in the coming years for clinical use for treatment of food allergies include epicutaneous immunotherapy (EPIT) for peanut, and sublingual immunotherapy (SLIT) for peanut.

In 2024, the first biologic agent (omalizumab) was also approved by the FDA for use in IgE-mediated food allergy, and not specific to peanut or any single food allergen. The OUtMATCH trial is an NIH-funded Consortium of Food Allergic Research study of children and adults with peanut and 2 other food allergies, and includes 3 phases. The results of stage 1 (omalizumab monotherapy versus placebo) showed that 16 weeks of omalizumab therapy improved the reaction threshold to peanut (from <100 mg protein to >600 mg protein) and other common food allergens (cashew, egg, milk, walnut, hazelnut, and wheat).

Given the above and other encouraging clinical trial results, as well as current and pending approvals for several food allergy therapeutic modalities, there will be many more options available for the treatment of food allergy in humans. Physicians and patients will need to together determine what specific treatments are most suitable for them.

Du Toit, G, Roberts, G, Sayre, PH, et al. Randomized trial of peanut consumption in infants at risk for peanut allergy. *N Engl J Med* 2015;372:803-813

Scott H. Sicherer, Elissa M. Abrams, Anna Nowak-Wegrzyn, Jonathan O'B. Hourihane, Managing Food Allergy When the Patient Is Not Highly Allergic, Journal of Allergy and Clin Immunol: In Practice. 2022 Jan; 10 (1): 46-55

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Wood RA, Togias A, Sicherer SH, et al. Omalizumab for the Treatment of Multiple Food Allergies. N Engl J Med. 2024 Mar 7;390(10):889-899.

WEDNESDAY, APRIL 30, 2025 | 11:30 AM

Diet Dilemmas: Interactive Cases with Multiple Diseases

DEBORAH LINDER, DVM, MS, DACVIM (NUTRITION)
Clinical Associate Professor
Cummings School of Veterinary Medicine at Tufts University
North Grafton, MA
www.petfoodology.org

Program Description

Can you feed a hydrolyzed diet to growing animals? How do I do a diet trial in a dog with pancreatitis? Through interactive case examples, attendees will have the opportunity to practice selecting diets for pets with multiple medical conditions. This session will provide a systematic approach to straight-forward and complicated cases as well as strategies, resources, and clinical tips to make managing cases easier.

Learning Objectives

By the end of this lecture, participants will be able to:

-Describe a systematic approach to creating nutritional goals and plans for pets with dermatologic and other comorbid conditions.

-Prioritize diets based on their nutrient profile and ability to meet nutritional goals for each patient.

-Identify resources and tools for providing evidence-based nutrition information to clients.

-Apply strategies and resources to help guide diet choice for easier nutritional management of patients.

Systematic Approach to Cases

When navigating the various diet options for healthy pets and those with medical conditions, particularly those that may have contradicting nutritional goals, it can be helpful to take a systematic stepwise approach to selecting diets.

1. Full nutritional assessment

a. This includes a full medical history, diet history, physical exam (including body condition score and muscle condition score), and diagnostic work up as indicated.

2. Creating a problem list

a. This can then be separated into problems that can be addressed with nutrition (e.g., diabetes, abnormal body condition, etc.), and those that would not modify nutritional goals outside those required for an otherwise healthy pet (e.g., some ophthalmic conditions like entropion, or some immune-mediated conditions that are not food-responsive).

3. Developing a list of all nutrients of concern

a. Each problem should have a list of accompanying nutrients of concern and goals for each nutrient (e.g., protein at AAFCO minimum but not excessive for an IRIS stage I CKD dog).

4. Prioritizing the nutrients into final nutritional goals

a. Considerations for prioritization could include

i. Short term vs long term needs (e.g., for a pet with a feeding tube, a canned diet with high kcal/ml when diluted may be prioritized short term)

ii. Potential for side effects/harm (e.g., for a growing large breed puppy, prioritizing diets that meet AAFCO growth, particularly calcium, phosphorus, and protein to avoid skeletal malformation)

iii. Severity of each condition (e.g., prioritizing fat levels in a patient with severe pancreatitis)

iv. Quality of life concerns (e.g., prioritizing textures or flavors based on a pets preference to ensure adequate calorie intake and minimizing struggle with family at mealtimes)

v. Ease of monitoring (e.g., prioritizing restricted copper which cannot be easily monitored frequently compared to renal or hyperlipidemia conditions)

5. Creating a chart of potential diets to compare nutrients

a. Using product guides or calling companies can provide nutrient info to make a chart

b. Comparisons should be done on an energy basis (grams or milligrams per 100 kcal), so nutrient info can be compared evenly (see "Pet Food Calculator" article on www.petfoodology.org for an online converter to energy basis: https://sites.tufts.edu/petfoodology/2017/08/07/nutrient_converter/)

6. Monitor and adjust nutritional goals based on patient response

a. At regular intervals determined by each set of conditions, conduct full nutritional assessments

b. Perform a full dietary history as lack of success may potentially be diet drift or non-adherence to the nutritional plan (e.g, providing high protein treat such as rawhide chews in a renal disease patient)

c. Pay particular attention to potential side effects from contradicting goals (e.g., monitoring triglyceride levels in a patient where another medical condition required a diet moderate in fat levels)

d. Reassess prioritization and adjust nutritional goals as warranted

Additional Diet Dilemmas and Considerations for Pets with Special Diets

Multi-pet households: Pet owners often ask if veterinary therapeutic foods can be fed to healthy pets, especially if there are multiple pets in the house. If the food meets AAFCO guidelines or has undergone AAFCO feeding trials for adult maintenance, it is likely appropriate for a healthy pet. However, it should never be assumed all other pets in the house are healthy and each pet should have a nutritional assessment to ensure dietary recommendations are appropriate. In general, veterinary therapeutic diets formulated for dental disease, gastrointestinal disease, and dermatologic often ***(*but not always!*)*** meet AAFCO guidelines for adult dogs and cats, but each diet should be assessed according to its AAFCO nutritional adequacy statement and each pet should be individually assessed to ensure appropriate dietary recommendations. It is most important not to make assumptions or generalizations (incorrect statements such as "all derm diets are low calorie or ok for healthy pets") as there are many diets on the market with a wide range of nutrient profiles available. This increase in diets available can be a positive to provide more options, but can be a negative if assumptions are made that lead

to inappropriate prescribing of therapeutic diets. There may be diets that are appropriate for multiple pets or multiple conditions but do not have specific indications on the label. For example, in the case of a pet with kidney disease wanting to try a dietary elimination trial, there may be therapeutic hydrolyzed protein diets that are moderate or at least not excessive in protein, phosphorus, sodium, and are non-acidifying, making them potentially appropriate for pets with early stage renal insufficiency.

Client Communication Strategies for Pets with Special Diets

Do include treats and medication administration: Almost all owners give treats and studies show up to 60% of owners provide medication with food items. While some veterinary therapeutic diets come in treat forms, this is not always possible. Without proper client communication, owners may also have special treats they are convinced won't affect treatment. Adherence can be increased by including treat and medication administration options that also meet nutritional goals (e.g., an alternative option to high-sodium peanut butter, cheese or deli meat for administering pills is banana slices).

Don't interchange flavors and formulations: Canned and dry versions of the same foods will not always have similar nutrient profiles. For example, while a dry version of hydrolyzed diet may be quite low in fat, the canned version of the same food may be moderate or high in fat, which would be a significant problem for a pet with IBD as well as pancreatitis that is being managed concurrently. Nutrient levels for macronutrients like fat or protein and for micronutrients like sodium and phosphorus may be drastically different between flavors or canned/dry versions. Be mindful of nutrient profiles and alert owners that only the specific formulations and flavors recommended should be used without consulting with their veterinarian first.

General Pet Nutrition Resources

2021 AAHA Weight Management and Nutrition Guidelines for Dogs and Cats:

https://www.aaha.org/aaha-guidelines/2021-aaha-nutrition-and-weight-management-guidelines/home/

Helpful Tips:

-Algorithms and flowcharts for getting a diet history and performing a nutritional assessment

-Conversation starters and example phrases

Vet Specialists ACVIM Website:

https://www.vetspecialists.com/specialties/nutrition

Helpful Tips:

-Resources for pet owners, veterinarians

-Directory of all board-certified veterinary nutritionists

World Small Animal Veterinary Association Nutrition Toolkit:

www.wsava.org/nutrition-toolkit

Helpful Tips:

-Handouts for pet owners on how to pick high quality pet foods

-Non-branded body condition score and muscle condition score charts

-Listing of vetted websites with trusted pet nutrition information

Pet Nutrition Alliance & Dare to Ask Project:

https://petnutritionalliance.org/resources/pet-food-manufacturer-evaluation-report/

Helpful Tips:

-Website that utilized example WSAVA guidelines to survey various pet food manufacturers

-Survey results reported online for comparison

Tufts Clinical Nutrition Service Petfoodology Website:

www.petfoodology.org

Helpful Tips:

-University website created by board-certified veterinary nutritionists with articles on FAQS about pet nutrition

-Example blog and available handout about common mistakes in diet trials available here and below: https://sites.tufts.edu/petfoodology/2022/04/04/think-your-pet-has-a-food-allergy-eliminating-mistakes-in-elimination-diet-trials/

Elimination Diet Trial Checklist:

(https://sites.tufts.edu/petfoodology/2022/04/04/think-your-pet-has-a-food-allergy-eliminating-mistakes-in-elimination-diet-trials/)

Elimination Diet Trial Plan for _____
(pet name)

Petfoodology
www.petfoodology.org

To be filled out by a veterinarian or questions owners can ask their veterinarian to help plan a successful elimination diet trial

Recommended length of trial (after transition to the new diet): _____ weeks
Date starting trial (after transition to the new diet): _____

Recommended diet(s)
Dry _____
Wet _____
Amount to feed _____

Recommended treats
_____
_____
☐Recommend no treats during trial

Recommended method to administer pills
_____

Other recommendations (heartworm and other preventatives, medications, etc)
_____
_____
_____

Checklist for Successful Elimination Diet Trials

Pet food:
☐ Feed only the food(s) recommended above.
☐Prevent access to the food of any other pets in the house (or in the neighborhood).

Treats:
☐Commercial pet treats: To do the most effective elimination diet trial, it's best to avoid all treat and to throw away (or give away) all commercial pet treats in the home to avoid temptation.
☐Avoid all rawhides, pig ears, bully sticks, and other treats made from dried animal parts.
☐Avoid all dental chews and any flavored chew toys.
☐Warn dog walkers, house guests, pet store clerks, and other people your pet encounters who might give treats.

People food:
☐Avoid giving your pet any people food (a sign on the refrigerator door or at the dining table can be very helpful as a reminder for everyone in the home). Even things you might not expect can ruin an elimination diet trial – this includes things like fruit or vegetables and things you might not think about, like marshmallows (or any other foods that contain gelatin).
☐If you have children who might drop food for the pet (or just drop food in the course of eating), the pet should be out of the room when they're eating.

Don't forget about:
☐Dietary supplements should be discontinued unless specifically recommended by your veterinarian (and known not to contain any ingredients that could trigger allergies).
☐Avoid pet toothpaste during the elimination diet trial (continuing to brush without toothpaste can help to maintain your pet's dental health during the diet trial).
☐Avoid any flavored medications, such as heartworm or flea/tick preventative. However, it is very important for your pet to continue to receive heartworm and other preventatives during the diet trial so talk to your veterinarian about unflavored options or topical preventatives that are put on the skin.
☐If your pet requires medications and you give pills in foods or pill wrap products, you'll need to talk to your veterinarian about different ways to ensure your pets gets their pills without foods during the diet trial.

WEDNESDAY, APRIL 30, 2025 | 2:00 PM

Making Client Communication Easier: Nutrition Mythbusting and Pet Food FAQs

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Program Description

'Should I Home-Cook for My Dog with Itchy Skin?' 'How Do You Know this Supplement Doesn't Cure Allergies?' Participants will walk away feeling more comfortable answering nutrition questions like these and having conversations with pet owners about myths, marketing, and evaluating pet foods. Troubleshooting case examples will provide ready-to-use and practical tools for the veterinary care team.

Learning Objectives

By the end of this lecture, participants will be able to:
-Describe and integrate available pet nutrition guidelines such as WSAVA into their daily practice.
-Identify various pet nutrition tools and resources to make client communication easier.
-Provide accurate responses to the most common questions about veterinary nutrition with pet owners

Communication Tips for Talking with Owners about Diets

Unfortunately there is no '100% safe guarantee' on any diet as there is still so much more we need to know and understand about optimal nutrition for our companion animals. Pet owners can easily and understandably be very frustrated and confused by contradicting information and advice. Utilizing a 'follow the evidence' communication style allows for recommendations to change as more information and studies are made known and also allows for more of a 'team approach' with pet owners that highlights the most important aspect and common goal – what's best for their pet. One example conversation starter could be, "There are no good or bad foods, just foods I have more information on so I have a higher level of comfort feeding this to my own pets because I know what testing has been done. A food without as much testing is not 'bad,' it is just an unknown because further testing has not been done. My job as a veterinarian is to make sure you know

about the various levels of testing and expertise a company can or should have so you can make the most-informed decision for your pet.'

Evaluating Claims from Diets, Treats, and Supplements

Companies that make claims about benefits of their product without evidence from peer-reviewed studies should be asked more about how they determined their claims and avoided if evidence of benefit cannot be provided. The more information that a company can provide, the more informed a decision can be when selecting diets. For example, some diets have been evaluated in clinical trials using either research colony animals or companion animals in home settings. When this product research is then published in peer-reviewed journals, it allows veterinarians to consider how the product was used (e.g., Only thing fed? For what duration?), in what population of animals (e.g., Only healthy pets?), and what expected outcomes would be (e.g., Did this change labwork? Change quality of life? Reduce medication needs?). One example of standardized product research is the Veterinary Oral Health Council (VOHC) that provides guidelines for clinical trials, populations, and outcomes required to receive a VOHC seal of acceptance for dental products.

Addressing Common Myths and Controversies in Pet Foods

Ingredients: This is usually the most surprising piece of information that pet owners hear when nutritionists describe how they determine high quality pet foods: pets require nutrients, not ingredients! A diet full of great sounding ingredients can be less nutritious than a diet containing ingredients that are marketed as negative. Further, some ingredients may be added in very small amounts solely for marketing purposes to increase the appeal of the diet to consumers. Ingredients can be looked at like puzzle pieces where, toxic ingredients aside, it is more helpful to consider how all the pieces come together to provide adequate nutrition than to focus on each puzzle piece.

Marketing and advertising: It can be challenging for pet owners to discern what is evidence-based information, has a legal definition, or is simply marketing or advertising. While it is not allowed to say a diet "cures" or "treats" medical conditions, this can sometimes be implied with softer language, such as 'promotes healthy teeth' or 'supports skin health.' Whether over the counter or a veterinary therapeutic diet, always ask companies how they decided their food provides any particular benefit or health claim. WSAVA guidelines provide more information about how to ask companies if they have conducted clinical trials in cats or dogs, shown a positive benefit, and then published those results in peer-reviewed journals. This way, other experts can review the research to ensure it was designed properly and results communicated accurately.

'No' diets: Another common aspect of marketing is when companies promote their foods by saying they have 'no ____', implying that whatever is not in their diet must be bad for your pet. This can be misleading and confusing to owners. One example of this is companies promoting their diets by saying they contain 'no by-products,' which by AAFCO definition is basically organ meats. However, I often counsel families that are worried about by-products but want to feed diets promoting organ meats specifically by name (for example, 'liver'), not knowing that is a by-product! This can be very confusing to owners because there have not been studies to show that diets without by-products are better or worse for pets than those with by-products. I try to explain to families that this provides information on what part of the animal the ingredient may come from, but it is not an indicator of quality.

Refresher on AAFCO statements

Every food (but not treats) should have an AAFCO statement that describes if the food is complete and balanced and what lifestage the food is appropriate for. These statements will tell you three things:

a) Is this food complete and balanced?
• If not, it will say "this product is intended for intermittent or supplemental feeding only." This means it does NOT have all the essential nutrients a healthy pet needs.
• Veterinary therapeutic diets may have this statement due to their modifications for diseases.

b) How did the company determine the food was complete and balanced?
• Companies can either do feeding trials or analyze their product to determine the food is complete and balanced.
• Feeding trials will state "Animal feeding tests using AAFCO procedures substantiate that ____ food provides complete and balanced nutrition…"
• Nutritional analysis only will state "____ food is formulated to meet AAFCO nutrient profiles…"
• Feeding trials test that pets have eaten this food in controlled settings, but ideally, companies have tested their foods by both methods to have as much information as possible about the diets.

c) Which lifestage is this food formulated for?
• AAFCO provides nutrient profiles and feeding trial requirements for growth, reproduction, and adult maintenance. (Note: there are NO senior guidelines!)
• Foods that say all life stages must meet minimum levels of both growth and adult.

• Since 2017, there is now additional notation on foods for growth that specify whether the food is appropriate for large breed dogs (those expected to be 70 lbs or larger at mature weight).

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WEDNESDAY, APRIL 30, 2025 | 3:00 PM

Changing Perspectives In Food Allergy: Are We Cracking The Code?

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Very few changes have been made in the past years regarding how we approach patients with suspected food allergies; we are still at a point where we are using diagnostic diet trials as the sole means of diagnosing patients with food allergies. And the diet trials are difficult to perform correctly, they are lengthy complicated to implement and dependent on the willingness and ability of clients to perform them.

Based on the current scientific evidence and research, available testing is not considered to be an appropriate tool for diagnosing food allergies in feline and canine patients.

But what are we basing the science that we used on? The reality is that Current recommendations rely on past dogma and decades spent repeating the same information, even if outdated and senseless. The series of documents that were produced by Doctor Thierry Olivry and Dr. Ralph Mueller (2016-2020)[1,2,3,4,5,6,7,8,9] make the point emphasizing the variation of the quality and the quantities of the studies that have been done in the past 30 years to make those recommendations, highlighting that this it is probably weak science. Some of the factors to consider are a limited number of studies, the small number of individuals enrolled in each study, the variations in criteria for diagnosing food allergy, the lack of a provocation in some of the studies, the type of diets that were used, the ingredients used for provocation, lack of clinical grading in many of them, and other interventions such as medications and topical therapies, just to name a few examples.

In human medicine, although there is much more information, studies, and reporting available. Estimating the prevalence of food allergies is challenging, with estimates ranging from 1% to 5%. The gold standard for assessment in the human patient is a controlled food challenge, which can only be conducted in specialized centers. Few large-scale studies have measured food allergy rates in the same population over time using consistent definitions, meaning most data on whether food allergies are increasing relies on indirect measures like anaphylaxis-related emergency department admissions. While food-related anaphylaxis likely accounts for a significant portion of these cases, precise figures are unavailable. Inconsistent definitions and reporting make it difficult to determine accurately. (9)

Clinicians want to base their recommendations using evidence-based medicine the reality is that the strength of what we have for food allergy in veterinary medicine is very limited and further research is needed and new avenues should be undertaken to identify clinical syndromes that help the clinician make better decisions ideally this would be accompanied by testing.

Another complicating factor is being able as a clinician to perform several different complicated tasks that are necessary to identify patients that will benefit from a diet trial and a food allergy diagnosis. The first question would be how we collect client information when taking a clinical history: Are we asking the right questions? Are we collecting the necessary information? For example: in most clinical settings, homologous pruritus and lesion grading is not performed routinely. There are multiple limitations to what clinicians can actually achieve working with clients and with patients due to several constraints such as the time, knowledge of the person bringing in the patient, the time that the patient has spent with the current owner and the degree of observation that the patient received the type of interpretation.

Regarding clinical manifestations, there was a period of time where certain lesions or pruritus distribution was correlated to food allergy, one example was perianal itching but after one study that did not find perianal itch to correlate to food allergy this was dismissed. [11] . Dogs that have a history of urticaria or angioedema should be identified during the clinical history because this could provide a clue as to the type of rection the patient is presenting, as these events are more related to food, medications or insect reactions and considered to be an IgE type of reaction. Careful clinical history and physical findings could improve our detection and differentiation of clinical syndromes.

Diagnostic tools mentioned before are limited to dietary trials and clinical observations. IgE serology testing with different methods has been available for a long time. [4,12] So far, the accuracy and correlation with clinical presentation has been lacking; new molecular testing could improve the value of these tests. Lymphocyte proliferation testing has been evaluated and used in Japan, and now, a new test could become available using this technology. [13,14,15,16,17]

In human medicine, food allergy testing is part of the diagnostic process; current recommended tests in clinical practice are basophil activation test, skin prick test, molecular allergology, combined with artificial intelligence can support clinical decision-making using a detailed history. Other tests that need more research before recommending are mast cell activation test, bead-based epitope assay. There are additional tests that are still under investigation and development. (18)

To align with the approach used in humans, we must differentiate food allergies based on their mechanisms (IgE vs. non-IgE-mediated), as this distinction has significant implications for the timing of relapses and the type of clinical symptoms. Otherwise, we risk conflating conditions like food-induced urticaria (IgE-mediated), which appears

within 30 minutes of consuming a food allergen, with food-induced atopic dermatitis (AD) (mixed or non-IgE-mediated), which flares up 48 hours after the same meal. Understanding this distinction is crucial for accurately characterizing clinical signs, determining whether an oral food challenge (OFC) should be conducted in the clinic (for IgE-mediated) or at home (for non-IgE-mediated), deciding if an elimination diet is necessary (for non-IgE-mediated), or if it can be avoided (if the dog with urticaria remains fine without eating the offending allergen) and choosing whether an extensively hydrolyzed diet or elemental diet (designed for IgE-mediated FA) can be used, or if another diet would be more appropriate.

Another important factor to consider when addressing allergies in children is therapeutics, particularly for peanut allergies. Unlike some other allergies, peanut allergies do not improve with age, and natural tolerance is not developed. Currently, immunotherapy, either alone or in conjunction with monoclonal anti-IgE therapy, is successfully being used to enhance the quality of life for affected children by reducing the likelihood of severe reactions or even fatal outcomes.([19,20])

In contrast, the severity and danger of food allergies in dogs and cats tend to be less pronounced, yet tolerance to food allergens also does not appear to develop in these animals, and this area has not been sufficiently studied. Nevertheless, utilizing immunotherapy for known allergies in dogs and cats could be beneficial. While research has been conducted, this treatment is not yet available commercially.([21,22])

Food allergy prevention could benefit our patients. Proposed interventions range from prenatal feeding practices to microbiome interventions. In the past, allergen avoidance was common in children, but current recommendations now emphasize early and controlled exposure to common allergens, such as peanuts, to help reduce the risk of developing food allergies.

Several factors are known to increase the likelihood of food allergies, including the early use of antibiotics and birth by cesarean section. These factors could potentially be mitigated or avoided. Patients with allergic conditions (CAD) generally benefit from early interventions that aim to reduce inflammation and limit excessive exposure to allergens, thereby decreasing the risk of new sensitizations.([23])

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WEDNESDAY, APRIL 30, 2025 | 9:00 AM

Radiology Meets Dermatology: A Collaborative Approach

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Introduction

The collaboration between radiologists and dermatologists is fundamental in diagnosing and managing complex dermatological conditions in veterinary medicine. While dermatology primarily relies on clinical examination, cytology, and histopathology, imaging techniques such as radiography, ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI) provide critical insights in evaluating dermatologic disorders with systemic implications. Through case-based discussions, the session highlighted how radiology enhances diagnostic accuracy, particularly in challenging cases.

Case-Based Imaging Applications in Dermatology

One of the most common dermatologic problems requiring advanced imaging is otitis. While otitis externa is often diagnosed through otoscopy and cytology, otitis media and/or interna necessitate imaging to evaluate deeper structures. Ultrasonography is useful in detecting fluid/soft tissue material within the tympanic bulla, especially in cats. CT provides a detailed assessment of bony structures and is particularly valuable in French Bulldogs and other brachycephalic breeds prone to otitis media due to their narrow ear canals and thickening of the tympanic bulla wall that precludes the use of ultrasound. MRI is the preferred imaging modality for peripheral vestibular syndrome, allowing for detailed visualization of fluid accumulation and soft tissue changes in the middle and inner ear, and any involvement of the central nervous system (otogenic intracranial infection secondary to otitis media or interna). In dogs with vestibular disorders, the presumed localization of the lesion identified with MRI matches the surgical findings in 90% of the cases.

Hepatocutaneous syndrome (aminoaciduric canine hypoaminoacidemic hepatopathy) is a systemic metabolic condition that has cutaneous manifestations and often requires imaging. Ultrasound plays an essential role in identifying characteristic hepatic changes. In dogs with hepatocutaneous syndrome, the liver can become highly hyperechoic with diffusely distributed hypoechoic regions, producing a characteristic honeycomb pattern.

Thymomas can also present with dermatologic signs such as exfoliative dermatitis, particularly in cats but it has also been reported in rabbits and goats. Affected animals may exhibit generalized scaling and alopecia, which may not immediately suggest an underlying thoracic mass. Thoracic radiographs often reveal a mediastinal mass, but CT provides superior resolution in assessing the size, extent, and invasiveness of the tumor. Advanced imaging is crucial in distinguishing thymomas from other mediastinal masses and in determining surgical planning and prognosis.

Hyperadrenocorticism is one of the most frequently diagnosed endocrine disorders in dogs and often manifests with dermatologic signs such as noninflammatory alopecia, skin atrophy, and calcinosis cutis among some. Radiographs are useful in detecting calcinosis cutis, which appears as dystrophic mineralization within the skin, while ultrasonography is routinely employed as part of the diagnostic workup in these cases. Pituitary-dependent hyperadrenocorticism (PDH) accounts for approximately 80% of naturally occurring cases in dogs. When a patient exhibits clinical signs and laboratory findings consistent with hyperadrenocorticism, PDH is suspected if both adrenal glands appear symmetrically enlarged on ultrasound. In contrast, adrenal tumor hyperadrenocorticism (ATH), which results from functional adrenocortical tumors, represents around 20% of cases. ATH should be considered when one adrenal gland is enlarged, contains a nodule, or is completely effaced by a mass, while the contralateral gland is small (≤5.0 mm) or not visible, suggesting suppression. For cases in which PDH is suspected, MRI of the brain can be performed to evaluate the pituitary gland, aiding in both diagnosis and treatment planning.

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WEDNESDAY, APRIL 30, 2025 | 10:00 AM

Radiology's Role in Veterinary Dermatology

AGUSTINA ANSÓN DVM PHD DECVDI

Introduction

Diagnostic Imaging plays an essential role in the diagnosis of a wide range of conditions in small animals. The four major imaging modalities used in dogs and cats—radiography, ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI)—each offer unique benefits. Understanding how these modalities work and when to apply them is key to achieving accurate diagnoses and planning effective treatments.

Imaging modalities

Radiography, one of the most widely used and accessible imaging techniques, relies on ionizing radiation to create two-dimensional images. X-rays are passed through the patient and absorbed at different rates depending on tissue density, producing images in shades of black, white, and gray. Bone, being dense, appears white, while gas-filled structures such as lungs or intestines appear darker. Soft tissues fall somewhere in between, which can limit the detail seen in structures of similar density. Radiography is especially useful in assessing the skeletal system, including fractures, joint disease, and bone tumors. It also plays a central role in evaluating thoracic conditions such as pulmonary patterns, cardiomegaly, pleural effusion, and masses. In the abdomen, it helps detect foreign bodies, gastrointestinal obstructions, organomegaly, and uroliths. While radiographs offer a quick and relatively inexpensive first step in many cases, their limitations in soft tissue contrast and their two-dimensional nature must be taken into account.

Ultrasound offers a different approach by using high-frequency sound waves instead of radiation. A transducer sends sound waves into the body, which then bounce back at varying rates depending on the characteristics of the tissues encountered. The echoes are translated into real-time images, allowing for dynamic evaluation of organs and movement. One of the major strengths of ultrasonography is its ability to differentiate soft tissues with excellent contrast, making it ideal for assessing abdominal organs such as the liver, spleen, kidneys, bladder, adrenal glands, and intestines. In dermatologic patients, abdominal ultrasonography is especially useful in the evaluation of systemic diseases with cutaneous manifestations. Ultrasound can be used to evaluate the tympanic bulla, particularly in cats. The tympanic bulla's relatively superficial location and large size make it accessible for transcutaneous imaging, allowing detection of fluid or soft tissue material within the cavity—offering a useful, non-invasive diagnostic tool when CT or MRI is not readily available. Ultrasound also allows for guided sampling of fluids, aspirates, and biopsies with minimal invasiveness.

Computed tomography uses X-rays and computer algorithms to generate cross-sectional images of the body. The patient is positioned inside a rotating gantry while X-ray beams are directed from multiple angles, producing detailed tomographic slices that can be reconstructed into three-dimensional images. CT provides excellent spatial resolution and is especially powerful in evaluating complex anatomic regions like the skull, nose, ears, and thorax. CT is invaluable in assessing the tympanic bullae in cases of chronic or recurrent otitis media and inflammatory polyps. CT also provides a detailed evaluation of thoracic masses such as thymomas in cats presenting with paraneoplastic exfoliative dermatitis, aiding in diagnosis and surgical planning. In oncologic patients, CT allows for accurate tumor localization, staging, and surgical planning. Abdominal CT, particularly when enhanced with intravenous contrast, can help differentiate adrenal tumors, characterize liver lesions, and detect portosystemic shunts. While CT is fast and ideal for many cases, it does expose patients to ionizing radiation and typically requires general anesthesia to prevent motion artifacts.

Magnetic resonance imaging differs significantly from the other modalities in that it does not use ionizing radiation. Instead, it uses a powerful magnetic field and radiofrequency pulses to align hydrogen protons in the body. When the magnetic field is briefly disrupted, the protons emit signals as they return to their original alignment. These signals are captured and processed into high-resolution images, particularly effective in visualizing soft tissues. MRI is considered the gold standard for imaging the nervous system. It plays a key role in evaluating patients with vestibular signs, as it allows visualization of the middle and inner ear and any possible extension into the brain. In cases of suspected pituitary-dependent hyperadrenocorticism, MRI can provide detailed views of the pituitary gland, aiding in both diagnosis and surgical planning. Despite its superior soft tissue contrast, MRI is more time-consuming and less widely available than CT, and it requires anesthesia due to its longer acquisition times and sensitivity to motion.

In summary, the judicious use of radiography, ultrasound, CT, and MRI can vastly improve the diagnostic capabilities of veterinarians treating dogs and cats. Each modality brings distinct strengths and limitations. Radiography and ultrasound are the cornerstones of general practice imaging, offering broad applicability and quick results. CT and MRI, while requiring more specialized equipment and expertise, provide unparalleled detail in complex cases and are indispensable in referral and specialty settings. Familiarity with these technologies and close collaboration with veterinary radiologists ensure that imaging is used efficiently and appropriately, ultimately leading to better clinical outcomes for our patients.

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WEDNESDAY, APRIL 30, 2025 | 11:30 AM

What if it is lymphoma? The Dermato-Oncologist Axis

DANA CONNELL

Introduction

Lymphoma is one of the most common malignancies in dogs and cats, affecting multiple organ systems, including the skin. It comprises up to 24% of new cancer diagnoses made in canines per year.[1] While multicentric lymphoma is the most frequently diagnosed form, cutaneous lymphoma presents unique clinical, diagnostic, and therapeutic challenges.[2] This presentation will provide an overview of the etiology, classification, diagnostic techniques, and treatment options for lymphoma involving the skin in canine and feline patients.

1. Etiology of Lymphoma in Dogs and Cats

Lymphoma arises from the malignant transformation of lymphocytes, typically originating in lymphoid tissues such as lymph nodes, bone marrow, or extranodal sites which can include the skin. While the exact cause remains unknown, genetic predisposition, environmental factors, and retroviral infections (such as feline leukemia virus in cats) are thought to contribute to disease development. Cutaneous lymphoma can be classified into epitheliotropic and non-epitheliotropic forms[3,4], each with distinct biological behaviors and prognostic implications, dependent upon location, extent of disease, and phenotype.[1,2]

2. Differentiating Multicentric and Cutaneous Lymphoma

Multicentric lymphoma primarily affects peripheral lymph nodes, often with systemic involvement and is the most common type of lymphoma diagnosed in dogs.[1,2] Dogs with this form may present with generalized lymphadenopathy, lethargy, and weight loss. Some dogs may present with involvement of the skin in the constellation of clinical signs seen with multicentric, or disseminated, lymphoma. In contrast, cutaneous lymphoma is a distinct entity with primary skin involvement, manifesting as single or multiple nodules, plaques, ulcers, or erythroderma.[3,4] Epitheliotropic lymphoma primarily affects T-cells and can involve mucocutaneous sites, whereas non-epitheliotropic lymphoma often arises from B-cells and presents as deeper dermal or subcutaneous masses, impacting presentation and management.

3. Diagnostic Techniques for Cutaneous Lymphoma

Accurate diagnosis requires a combination of clinical evaluation, cytology, histopathology, and immunophenotyping. Fine-needle aspiration (FNA) of affected lymph nodes or skinlesions can provide preliminary cytological evidence, but biopsy with histopathology remains the gold standard for definitive diagnosis. Thicker areas may be aspirated and advanced diagnostics such as flow cytometry and PCR for Antigen Receptor Rearrangement (PARR) may be useful for early diagnosis. Immunohistochemistry and flow cytometry can help differentiate between B-cell and T-cell lymphoma, which has been described as one of the most important prognostic factors in multicentric lymphoma. Flow cytometry can also provide additional information about the cell surface markers of lymphoma cells, providing added prognostic information. [5] Additional experimental work has been done to explore options for differentiating early neoplastic cells from reactive T-cell infiltrates.[6]

4. Treatment Options and Prognostic Considerations

Treatment of cutaneous lymphoma varies based on disease type, stage, and patient factors. Multicentric lymphoma in dogs typically responds well to CHOP-based chemotherapy (cyclophosphamide, doxorubicin, vincristine, prednisone), leading to prolonged remission in many cases, but is still almost uniformly terminal with less than 5% of patients considered cured of their disease.[7] However, cutaneous lymphoma is more challenging, with variable responses to corticosteroids, retinoids, and lomustine (CCNU), which is the mainstay of chemotherapy, among others. Radiation therapy and surgical excision may be considered for localized lesions, while novel therapies such as targeted immunotherapy and tyrosine kinase inhibitors are under investigation. Recent investigation into the use of common small molecule inhibitors such as Apoquel for the treatment of cutaneous lymphoma is ongoing, along with other investigative techniques.[1]

Prognosis depends on lymphoma subtype, response to treatment, and overall health status. While multicentric lymphoma can achieve extended remission with aggressive therapy, cutaneous forms often have a more guarded prognosis, particularly in cases of disseminated disease. Early diagnosis and a multimodal approach are key to optimizing patient outcomes.[5,8,9]

Conclusion

Recognizing the distinctions between multicentric and cutaneous lymphoma in dogs and cats is critical for accurate diagnosis and effective treatment planning. Advances in diagnostic techniques and evolving therapeutic strategies continue to improve survival and quality of life in affected patients. This presentation will provide clinicians with the knowledge to better manage lymphoma involving the skin, ultimately enhancing patient care in veterinary dermatology.

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WEDNESDAY, APRIL 30, 2025 | 2:00 PM

What if it is NOT lymphoma? The Dermato-Oncologist Axis

DANA CONNELL

Introduction

Cutaneous cancers in dogs and cats represent a significant portion of dermatologic and oncologic cases seen in veterinary practice. These tumors can arise from various cell types, with diverse clinical presentations and biological behaviors. Early recognition, accurate diagnosis, and appropriate treatment are essential for optimizing patient outcomes. This presentation will cover key risk factors, common clinical manifestations, diagnostic techniques, treatment strategies, and paraneoplastic syndromes associated with cutaneous cancer in dogs and cats.

1. Risk Factors for Cutaneous Cancer in Dogs and Cats

Several risk factors contribute to the development of cutaneous neoplasia in dogs and cats, including:
Genetic Predisposition – Certain breeds are more prone to specific cancers, such as Boxers and Golden Retrievers with mast cell tumors or Siamese cats with squamous cell carcinoma.[1]
Ultraviolet (UV) Radiation – Sun exposure is a major risk factor for cutaneous squamous cell carcinoma, particularly in lightly pigmented or sparsely haired areas. [2]
Chronic Inflammation or Trauma – Persistent irritation or non-healing wounds can predispose to neoplastic transformation, as seen in feline injection-site sarcomas.
Viral Infections – Feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV) are associated with an increased risk of cutaneous lymphoma in cats.
Age – Older animals are more prone to neoplasia due to cumulative DNA damage over time.[1]

2. Common Presentations of Cutaneous Cancer

Cutaneous neoplasms in dogs and cats can present with diverse clinical signs, including:
Mast Cell Tumors (MCTs) – The most common malignant skin tumor in dogs, appearing as raised, erythematous, or ulcerated masses that may change in size.
Squamous Cell Carcinoma (SCC) – Often found on the ears, nose, and eyelids of cats, presenting as ulcerative, crusted lesions.
Cutaneous hemangiosarcoma – Often found on the abdomen of light-haired dogs and have very different biologic behavior compared to visceral counterparts

Melanomas – Found on haired skin or in the oral cavity, with malignant forms being more common in mucosal locations.
Apocrine gland carcinoma – Seen in dogs more commonly with variable biologic behavior.
Uncommon manifestations of other tumors which can affect skin can also confuse the clinical picture.[1,3]

3. Diagnostic Techniques for Cutaneous Cancer

A systematic diagnostic approach is crucial for accurate tumor identification and treatment planning. Common diagnostic techniques include:
Fine-Needle Aspiration (FNA) – A minimally invasive method useful for cytological evaluation of mass lesions, though the utility may be limited by the features of the tumor.
Biopsy (Incisional or Excisional) – Required for histopathological diagnosis, grading, and immunohistochemical analysis.
Advanced Imaging – Radiography, ultrasound, and computed tomography (CT) help assess tumor invasiveness and metastasis, particularly for deep or aggressive tumors.
Immunohistochemistry and Molecular Testing – Useful for differentiating poorly differentiated neoplasms and confirming specific tumor markers (e.g., KIT staining for mast cell tumors).

4. Treatment Options and Prognosis

Treatment options depend on tumor type, size, location, and metastatic potential. The most common treatment modalities include:
Surgical Excision – The primary treatment for most localized skin cancers, with appropriate margin planning dependent upon tumor type and suspected biologic behavior.
Radiation Therapy – Effective for incompletely excised tumors or in cases where surgery is not feasible, such as nasal planum SCC in cats.
Chemotherapy – Used for systemic cancers or tumors with a high metastatic rate, such as high-grade MCTs.
Targeted Therapy – Tyrosine kinase inhibitors (e.g., toceranib) are used for recurrent or metastatic MCTs in dogs.
Electrochemotherapy and Immunotherapy – Emerging modalities showing promise in cases like SCC and melanoma.

Prognosis varies based on tumor type and stage. While many benign tumors can be cured with surgery, aggressive cancers may have a guarded prognosis despite multimodal therapy.

5. Paraneoplastic Syndromes Associated with Cutaneous Cancer

Some cutaneous cancers cause systemic effects known as paraneoplastic syndromes, including
Nodular Dermatofibrosis – May be associated with renal cystadenocarcinoma manifesting as firm dermal nodules
Paraneoplastic Pemphigus – May be associated with lymphoma manifesting as vesicobullous lesions
Thymoma-Associated Exfoliative Dermatitis – A rare condition in cats characterized by generalized scaling and alopecia.
Feminization Syndrome– May be associated with testicular tumors manifesting as linear preputial dermatosis and alopecia
Superficial Necrolytic Dermatitis- May be associated with a glucagonoma manifesting as multifocal crusts
Feline Paraneoplastic Alopecia- May be associated with biliary or pancreatic carcinoma manifesting as bilateral alopecia[4]

Conclusion

Cutaneous cancers in dogs and cats are diverse in presentation and behavior, necessitating a thorough understanding of risk factors, diagnostic approaches, and treatment options. Advances in oncology and dermatology continue to improve outcomes, emphasizing the importance of early detection and multimodal therapy. This presentation will equip veterinarians with the tools to diagnose and manage cutaneous cancers effectively, improving patient care and prognosis.

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WEDNESDAY, APRIL 30, 2025 | 3:00 PM

Skin Biopsy Tips, Tricks, and Trips (Part 1 and 2)

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Skin disease is a common problem in many of our veterinary species and it a one of the most common reasons for an animal to present to a veterinarian. Skin biopsy is a very powerful diagnostic tool in dermatology. It can diagnose many conditions, but it is neither required nor preferred in certain patients. The skin biopsy should not replace more basic parts of the diagnostic work-up such as a thorough history including the 3 D's: duration of clinical signs, description of lesions, and distribution of lesion. And we don't want to orgot one of the most important parts of the history which is pruritus; and even more important which came first, the lesion or the pruritus. This is important in differentiating primary pruritic conditions such as allergic dermatitis from other conditions. All of this information is taken into account when formulating your differential diagnosis. Also, in our diagnostic work-up there is almost always other less invasive diagnostic tests (such as cytology, skin scrapes, trichogram, cultures) that can and often should be performed before making the decision to take skin biopsies. Skipping these steps in your diagnostic work-up can lead to non-diagnostic samples, money wasted, a delay in the accurate diagnosis, and an unhappy client.

Before you decide to take skin biopsies, remember that it may not provide a clear definitive diagnosis. In many cases, it provides the practitioner with a morphologic diagnosis of the main patterns and features in the skin and the pathologist uses this information along with the signalment, history, presence or absence of pruritus, which came first - lesion or pruritus, lesion description, lesion distribution, and duration to provide you with a list of differential diagnoses. Unless the histology is completely clear, i.e. ectoparasites, microorganisms or neoplastic cells are seen, the pathologist must have patient information to interpret the histopathologic changes. And even in cases like pemphigus foliaceous, just because the pathologist sees acantholytic keratinocytes, they really do need other patient information to confirm the diagnosis because other conditions such as infections can cause acantholysis and produce acantholytic keratinocytes. This leads me to the point that you will get the most reliable diagnosis from your skin biopsy if you submit to a dermatopathologist rather than a general pathologist. The reason is because dermatopathology can be complicated and a requires some clinical knowledge of skin disease presentation and treatment. Dermatopathologists usually have additional training in skin pathology and often a better understanding of the clinical presentations allowing for a more comprehensive approach

to the case, which often gives the clinician more useful information for the patient.

Certain guidelines need to be followed to get the best results from the skin biopsy. In this lecture, we will discuss why, when, where, and how to take the most diagnostic skin biopsy samples.

1. Why to biopsy skin:

- To obtain a diagnosis in cases where other diagnostics have not been helpful
- To confirm a clinical diagnosis is accurate prior to starting expensive, dangerous, or labor-intensive medications and other therapies
- To help identify a life-threatening disease to initiate therapy as soon as possible
- To obtain a histologic diagnosis for a neoplastic condition so that a prognosis can be provided and surgical planning and other treatment management can be established

2. When to biopsy skin:

- When lesions are unusual
- When skin lesions are severe.
- When lesions fail to respond to an apparently appropriate course of therapy
- When lesions develop while on presumed appropriate therapy
- When therapy is considered dangerous, expensive, or labor intensive.
- When neoplasia is suspected (nodule, chronic non-healing ulcerative lesion).

3. Where to take the skin biopsy specimens:

- Primary lesions of all types should be sampled first (macules, paopulesar, pustulesar, nodules, plaques, vesicles, bullae, and wheals, erythema). *non-treated, fully developed primary lesions are the most diagnostic*
- If there are no primary lesions, you may want to wait until new lesions develop before taking biopsy samples
- As a rule, biopsy “all” suspect lesions. Lesion collection should be based on the differential diagnosis (ddx). For example, if pemphigus foliaceous (PF) is on the ddx list then pustules should be collected first and if there are not many pustules then submit crusts because crusts are essentially dried up exudate from ruptured pustules (in cases of PF).
- Collect secondary lesions (crusts, scale, collarettes, etc.) if they are a significant part of the disorder. Crusts can be very useful especially in conditions such as pemphigus foliaceous and dermatophilosis. If you submit extra crusts with your

tissue samples, please include a note requesting that the crusts be processed for histopathology.

- Always collect the center of the lesion except in cases of ulcerative disease, depigmenting conditions, and alopecia
  a. For ulcerative lesions, collect the sample on the margin of intact skin extending into the ulcer (elliptical or wedge).
  b. For depigmenting lesions, collect samples at the margin between pigmented and non-pigmented (elliptical or wedge).
  c. For alopecic/hypoertrichotic disorders, collect froorm areas with most alopecia, partially hairless, and normal and label separately.
- Remember that the normal microscopic anatomy of the skin may vary between body locations. For example, skin from the ventrum usually has fewer pilosebaceous units and therefore fewer hair follicles and smaller sebaceous glands. Thus, if an atrophic condition is suspected, such as an endocrinopathy the ventral abdomen is NOT the ideal site for biopsy.
- Consider complete excision for a solitary nodule.

4. How to take skin biopsy specimens:

General Concepts:

- Use a 6- or 8-mm punch biopsy on most cases. Smaller diameter punches (4mm) should only be used when a larger biopsy is technically difficult or could result in visible scarring (pinna, paw pad, near mucocutaneous junction).
- Treat bacteria and yeast infections first! Secondary infections are common, and histopathologic reactions obscure the pattern of other diseases.
- The effects of glucocorticoids can markedly modify reaction patterns and should be stopped for 2-3 weeks prior to biopsy (longer for injectable steroids- 6 weeks).

Biopsy Technique:

- NEVER scrub the skin surface, this could remove important diagnostic information. (This is NOT a sterile procedure!)
- Trim hair with scissors or clippers (#40 blade). Trim above area of abundant scaling and crusting.
- If local anesthetic is used: SQ bleb of 0.5-1cc of 2% lidocaine. (Do not use more that 0.5cc in animals under 10lbs). Inject in the subcutis, not the dermis. (General anesthesia may be necessary for some animals and at certain sites such as mucocutaneous junctions, nasal planum, pawpad, and pinna.)

- Position the punch over the center of a lesion (preferably), rotate punch in one direction only until it sinks into the subcutis.
- Support the plug of tissue from its underside (do not crush) and cut free with iris scissor. Blot on gauze to remove excess blood.
- Time from removal of biopsy to formalin immersion should be as short as possible (seconds, not minutes).
- Close with one cruciate or two simple interrupted sutures.
- Elliptical or wedge biopsies should be used for larger and deeper lesions (nodules, neoplasms, panniculitis), fragile lesions (large pustules, bullae, vesicles), and when taking samples from ulcerated lesions and depigmenting lesions. Aim to orient the ellipse along the way the hair grows so the follicles can be examined longitudinally.
- Placing the biopsy on a piece of tongue depressor or cardboard to minimize curling during fixation is optimal for thin biopsy specimens (not necessary for full thickness punch biopsies). Allow tissue to dry on the tongue depressor for 30-60 seconds before placing in formalin. NEVER attach the tissue with needles or sutures, this will cause significant artifact. *Keep in mind that the pathologist will transect the specimen through its long axis, symmetrically and perpendicularly to the skin surface.
- Take at least three skin biopsy samples, 3-5 is a good number to target.

B. Fixative:

- Use 10% neutral buffered formalin at a ratio of 1:10, tissue to formalin. Depending on how cold it gets in your area, during winter months add 1 part 70% ethyl alcohol to 9 parts formalin to prevent tissues from freezing while in transit. Freezing causes tissue artifacts than may hinder the interpretation of the lesions by the pathologist.
- Results from “alternative” (formalin-free) fixatives are not as good as fixing tissue in formalin.
- Formalin is a proven irritant, a proven sensitizer to delayed hypersensitivity responses and a known carcinogen. It should be handled with caution. If your container leaks in the mail, the post office may send the sample back to you.
- Michele’s media was once used as a fixative to evaluate for the deposition of immunoglobulins in the skin. Now equivalent results can be obtained with formalin-fixed tissues.

C. Sample Submission:

- Include brief but complete history, signalment, description of lesion, location of lesions, duration of lesion

- Include presence orf absence of pruritus and which came first, pruritus or lesions
- Include pertinent medical history, including diagnostic tests and results, response to treatment, and current medication and doses the patient is taking.
- Include differential diagnosis(es) and a map of lesion locations.
- Digital photos of the patients' lesions in your submission is very helpful. Pictures really do say 1000 words!
- Submit your skin biopsy cases to a dermatopathologist and establish a relationship with them. Don't be afraid to contact the pathologist when you are not sure what to biopsy or how or when to biopsy. And don't be afraid to contact your dermatopathologist when the results you received do not make sense. The dermatopathologist is also committed to getting you the right answer and most helpful information to help each patient.

D. Skin Biopsy DON'Ts:

- Don't take a punch biopsy within the center of an ulcer
- Avoid using a punch biopsy on large pustules or blisters (bullae) as rotation can shear the top off of the lesion (Use excisional biopsy technique – ellipse or wedge)
- A punch biopsy should not be used to sample neoplastic or inflammatory diseases in the subcutaneous fat. Biopsy punches may do not get deep enough for an adequate sample. If an ellipse or wedge cannot be performed, taking a smaller punch biopsy within a wider punch biopsy site ("stacked punch") can allow for sampling of deeper lesions.
- Don't scrub the biopsy site- you may remove important information in the crusts.
- Don't use dull or previously used punch biopsy instruments.
- Don't squeeze the biopsy with forceps.
- Don't use cautery on small samples such as punch biopsies.
- Avoid using small (<4mm) punch biopsy instruments.

10 Key points:

1. Do basic diagnostics first (cytology, skin scrapes, trichogram)
2. History should include presence of pruritus and which came first, lesion or pruritus
3. Remember the 3 D's -description, distribution and duration of lesions
4. Don't scrub the biopsy site
5. Biopsy the center of the lesion – most of the time!
6. Elliptical biopsy samples are best in cases of ulceration, depigmentation, deep, and fragile lesions
7. Take multiple biopsy specimens
8. Submit to a dermatopathologist
9. Submit clinical images
10. Avoid anything smaller than a 6mm punch biopsy specimen

Common misconceptions/mistakes:

1. Blinding the pathologist to the clinical history.
2. Taking samples from the margin.
3. Collecting only one biopsy sample or a specimen that is too small.
4. Not providing adequate history and medical information.
5. Describing crust in the clinical history and then not submitting it!
6. Assuming histopathology will give a definitive diagnosis (getting the most from you're your histopathology specimens requires careful patient selection, lesion selection and proper biopsy technique and even then may have a list of ddx and not definitive answer).

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WEDNESDAY, APRIL 30, 2025 | 9:00 AM

Applied Artificial Intelligence in Veterinary Medicine: Fundamentals and Advances (Part 1)

DR. NEOKLIS APOSTOLOPOULOS, DVM, DECVD

Artificial Intelligence (AI) is an emerging field in veterinary medicine, with the potential to elevate the standard of patient care, enhance diagnostic precision, and broaden access to specialist-level expertise in geographically isolated and underserved populations. The concept of AI dates back to the 1950s, but its application in medicine has accelerated over the past decade due to advancements in computing power and data availability.[1,2] In healthcare, AI is being used to analyze medical images, genetic data, and clinical notes, enhancing disease detection and patient care.[2] Similarly, in veterinary medicine, AI is applied in diagnostic imaging, disease prediction, and precision medicine, offering new insights into animal health management.[1,2] As AI continues to evolve, it promises to improve both human and animal healthcare by providing faster, more efficient and accurate clinical decisions. Successful integration of AI into clinical practice requires a foundational understanding of its core principles and terminology. This session will provide an overview of key AI concepts and their clinical relevance.

AI refers to computational systems engineered to emulate human cognitive functions, including learning, reasoning, problem-solving, and clinical decision-making. In the context of veterinary medicine, AI applications span predictive analytics, precision medicine, and clinical decision support systems, all of which contribute to improved diagnostic accuracy and therapeutic outcomes.[3]

Machine Learning (ML), a subset of AI, enables algorithms to learn iteratively from large datasets without explicit programming. ML techniques can be applied to analyze patient health records, predict clinical outcomes, personalize treatment strategies, and optimize the efficiency of veterinary healthcare delivery systems.[2]

Deep Learning, is a specialized branch of ML, resembles the neural architecture of the human brain. Deep learning algorithms are capable of processing large, complex datasets, such as medical images. In medicine, these models are employed in tasks including advanced image analysis, disease detection, and prognostic forecasting, contributing to significant improvements in diagnostic accuracy.[3]

Convolutional Neural Networks (CNNs) are a class of deep learning algorithms optimized for image recognition and analysis. CNNs sequentially process imaging data through multiple convolutional layers, extracting hierarchical features that enable the identification and classification of anatomical structures and pathological lesions. CNNs are widely utilized in veterinary radiology and dermatology for tasks such as lesion segmentation, tumor detection, and image enhancement.[4]

Natural Language Processing (NLP) encompasses AI methodologies designed to facilitate the interpretation, processing, and generation of human language by computers. In veterinary healthcare, NLP algorithms streamline the analysis of electronic medical records, automate clinical documentation, enhance client communication, and support clinical decision-making by extracting relevant information from unstructured text data.[3]

Large Language Models (LLMs) represent advanced NLP frameworks capable of processing vast textual corpora and generating contextually appropriate, human-like language. Within veterinary medicine, LLMs can assist in literature review, clinical guideline synthesis, diagnostic decision support, and the automation of administrative workflows, including the detection of potential adverse events through comprehensive data analysis.[5]

Multimodal Large Language Models (MLLMs) extend the capabilities of LLMs by integrating multimodal data inputs, including textual, visual, and auditory information. In clinical practice, MLLMs can improve diagnostic workflows by concurrently analyzing medical images and clinical notes, enhancing the accuracy and efficiency of veterinary diagnostic imaging interpretation.[5]

An **Algorithm** is a defined set of instructions that guides AI systems to perform specific analytical tasks or solve complex problems. In veterinary applications, algorithms underpin a variety of functions, including medical image interpretation, disease risk stratification, and the delivery of evidence-based clinical recommendations.

Predictive Analytics leverages historical and real-time data to forecast future clinical events. In veterinary healthcare, predictive models can identify patients at increased risk of disease progression, anticipate outbreaks of infectious disease, and facilitate proactive clinical interventions, thereby improving patient outcomes.[6]

Image Classification involves training computational models to categorize medical images into predefined diagnostic categories. For instance, AI systems can differentiate between species or classify dermatological lesions based on labeled imaging datasets.[7]

Object Detection expands upon image classification by simultaneously identifying and localizing multiple anatomical structures or pathological findings within a single image. This capability is critical in real-time diagnostics, enabling clinicians to pinpoint lesions, foreign bodies, or anatomical anomalies with high spatial accuracy.[7]

Python is a high-level programming language widely adopted in the development of AI applications, offering a versatile and efficient environment for constructing and deploying machine learning and deep learning models.[7]

PyTorch is an open-source machine learning library that provides a flexible platform for building and training neural networks. It is frequently utilized in veterinary and medical AI research for developing advanced diagnostic algorithms.[7]

Training Weights refer to the adjustable parameters within neural networks that are refined during the training process. These weights directly influence the model's ability to generalize and make accurate predictions, particularly when applied to specialized veterinary datasets, such as those used in otoscopic image analysis.[7]

Precision is an evaluative metric that quantifies the proportion of true positive predictions among all positive predictions generated by an AI model. High precision is essential in clinical applications to minimize the rate of false positives, thereby reducing diagnostic error.[7]

Recall, also known as sensitivity, measures a model's ability to identify all true positive cases within a dataset. In veterinary diagnostics, a high recall rate ensures critical pathologies are detected, minimizing the likelihood of missed diagnoses.[7]

The **F1-Score** represents the harmonic mean of precision and recall, providing a balanced assessment of a model's diagnostic performance, particularly valuable when dealing with datasets that exhibit class imbalances.[7]

Mean Average Precision (mAP) is a metric used to evaluate the performance of object detection algorithms. Calculated using the Intersection over Union (IoU) threshold, typically set at 0.50, mAP reflects the model's precision across multiple object categories.[7]

Prediction Performance encompasses an AI model's proficiency in recognizing, localizing, identifying, and categorizing features or pathologies in clinical data. It does not, however, extend to forecasting disease progression or patient prognostication.[7]

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WEDNESDAY, APRIL 30, 2025 | 10:00 AM

Applied Artificial Intelligence in Veterinary Medicine: Fundamentals and Advances (Part 2)

DR. NEOKLIS APOSTOLOPOULOS, DVM, DECVD

Introduction

Early applications of Artificial Intelligence (AI), focused on general tasks like risk assessment and image analysis. Nowadays, AI has progressed into more specialized areas of both human and veterinary medicine. This shift has redefined diagnostic practices, enabling earlier detection of disease, and improved access to care across various clinical settings.

AI in Dermatology and Otology

AI has demonstrated diagnostic utility in diverse areas of medicine. In dermatology and otology—both human and veterinary—the integration of artificial intelligence is rapidly progressing, especially through the development of CNN-based image classifiers and object detection models.

In veterinary dermatology, AI is in its infancy. In the most recent studies, AI has being used to identify skin lesions of the paws and the ear canal of dogs.[1,2] The Pawgnosis model, based on the Tiny YOLOv4 architecture, was trained to detect healthy, inflamed, or neoplastic lesions on canine paws.[1] It achieved a mean average precision (mAP) of 0.95, demonstrating strong diagnostic performance when integrated into real-time detection systems. Similarly, a YOLOv5-based model was developed to identify healthy ear canals, otitis, and masses in canine external ear images.[2,3] It showed robust precision and recall, although data duplication in training sets led to inflated performance metrics, emphasizing the need for rigorously curated datasets. Previous studies used image classification to diagnose dermatophytosis, mange and fleas,[4] whereas another evaluated multiple canine skin diseases.[5] In 2022, a study utilized images of dogs with fungal skin infections, bacterial dermatitis, and allergies; however, critical details were lacking regarding diagnostic methods, the presence of secondary infections, and the expertise of those making the diagnoses in veterinary dermatology. This limited the clinical relevance and interpretability of the findings.[6]

In human medicine, CNN-based classifiers such as Xception and MobileNet-V2 have been used to identify acute otitis media (AOM), otitis media with effusion (OME), and normal ears in pediatric patients. Wu et al. reported accuracy levels of up to 97.4% using endoscopic and smartphone-acquired otoscopic images, underscoring AI's capability for

remote and home-based monitoring.[7] Livingstone et al. used Google Cloud's AutoML to create a multilabel classifier trained on 1,366 otoscopic images, achieving a diagnostic accuracy of 88.7%, significantly outperforming general physicians.[8] Another study by Chen et al. leveraged a smartphone-compatible CNN ensemble for diagnosing middle ear diseases with an accuracy of 97.6%, outperforming even specialists in some categories.[9]

The human-dermatology field has embraced AI in the classification of inflammatory dermatoses and neoplasms. AI algorithms now assist in differential diagnosis, monitor chronic inflammatory conditions, and even assess treatment outcomes. Their integration has advanced the specialty beyond a descriptive, visual field to one of precision medicine, combining image-based phenotyping with systemic health insights. [10]

AI Applications in other specialties

In farm animals, YOLO-based object detection models have been deployed in mobile apps to detect digital dermatitis in dairy cattle, with real-time feedback and moderate-to-high agreement with veterinary assessments.[11] Beyond image-based diagnostics, artificial intelligence is rapidly expanding into areas of veterinary public health, antimicrobial resistance (AMR), and disease prediction. Several studies highlight how machine learning models, can effectively impute missing minimum inhibitory concentrations (MICs) in AMR datasets, aiding surveillance and stewardship policies .[12,13] AI/ML is used on antimicrobial resistance prediction, genomic surveillance, and post marketing safety evaluation, while emphasizing human-led governance and model transparency.[13] Additionally, researchers are exploring AI-driven behavioral communication strategies using generative models like ChatGPT-4 to tailor multilingual and culturally specific AMR awareness messages.[14] These efforts demonstrate AI's potential to support One Health Medicine approach.[14] Finally, structured insurance data has been used in predictive modeling for disease onset in cats, with machine learning identifying early risk patterns for conditions like periodontal disease and skin tumors.[15] These studies underscore AI's versatility in both individualized care and population-level veterinary epidemiology.

Conclusion

AI is rapidly reshaping the clinical landscape of both human and veterinary dermatology and otology. Through the development of CNN-based models for image classification and object detection, clinicians are now equipped with powerful tools to improve diagnostic accuracy, especially in complex or resource-limited settings. While challenges remain in dataset quality, model validation, and clinical integration, the current body of evidence strongly supports AI's growing role as an adjunct to traditional diagnostic workflows, with tangible benefits for patient care, education, and health system efficiency.

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WEDNESDAY, APRIL 30, 2025 | 11:30 AM

The Future Of Veterinary Medicine In A Multicultural World

DR. MILLIE ROSALES DVM, DACVD

Immigration to the United States

In 2022, the United States was home to 46.2 million immigrants, one of the highest numbers in its history, comprising 13.9% of the total population that year [1]. Immigrants primarily come from Latin America and Asia, with Mexico representing the largest group (23%), followed by India (6%) and China (5%) [1]. Immigration from South American countries such as Venezuela, Colombia, Brazil, Ecuador and Peru have seen rapid increases in the past twenty years, driven by economic and political instability in those regions [2] [1]. Central American immigrants, particularly from El Salvador, Guatemala, and Honduras, have grown rapidly within the past 5 years, with many settling in coastal states or southern border states [3].

Immigrants are concentrated in states like California, Texas, Florida, New York, and New Jersey, with major metropolitan areas such as New York City, Los Angeles, and Miami hosting large immigrant populations [1]. Some states have seen significant growth in their immigrant population on a percentage basis since these states had a small foreign-born population to begin with. For example, North Dakota's immigrant population grew by 131 percent [1]. Overall, the influx of immigrants continues to shape the demographic and economic landscape of the U.S. across various regions.

Immigrants and language

In the United States, a sizable portion of the population speaks languages other than English at home. As of 2022, approximately sixty-nine million people, or 22% of the population, reported speaking a language other than English at home [1]. Among them, Spanish is by far the most common language, spoken by 61% of these individuals [1]. Other frequently spoken languages include Chinese (5%), Tagalog (3%), and Vietnamese, Arabic, and French, each spoken by about 2% [1]. Many immigrants in the U.S. face challenges with English proficiency—46% of immigrants, or 21.1 million people, report speaking English less than "very well," highlighting the language barriers that can affect communication and access to services [1].

Immigrants, their culture, and pet care

Immigration acts as a powerful catalyst for cultural diversity. There are various definitions of culture depending on which book, article, or website you read. Culture is in general defined as the shared beliefs, values, customs, behaviors, opinions, and social forms of a

particular group of people at a particular time. [4] [5]. It includes elements such as language, art, social norms, and rituals that are passed down through generations, shaping how individuals understand and engage with the world [6]. Culture is dynamic, constantly evolving as it adapts to new experiences and influences, and it deeply impacts how people think, act, and interact within their community [7].

Culture plays a crucial role in shaping pet ownership and pet medical care, as it affects the types of animals' individuals choose to keep, the way pets are viewed within the family, and their overall treatment [8] [9]. In some cultures, pets are considered beloved companions and integral members of the household, while in others, animals may be viewed more as working creatures or even as unclean, leading to different levels of attachment and care [8] [10]. Additionally, cultural differences can also affect how pets receive medical care, as some communities may prioritize veterinary visits and treatments, while others may not [9]. Understanding cultural influences is essential for improving pet healthcare and ensuring that pets receive the appropriate attention in a culturally sensitive manner.

Culturally responsive care within veterinary medicine

Cultural competence and cultural humility are essential for veterinarians to provide inclusive and effective care for the diverse range of pet owners they serve. Cultural competence within the concept of medical care involves acquiring the skills and knowledge of how cultural and social factors shape healthcare experiences, while cultural humility emphasizes the importance of ongoing self-reflection and acknowledging one's own cultural biases and how culture affects medical decisions [7], [11], [12] [13]. Having these skills will enable veterinary professionals to better understand clients' perspectives on pet care, including differing views on treatments such as sterilization or health interventions. By practicing culturally responsive care, veterinarians can improve client satisfaction, enhance animal care, and build stronger relationships with culturally diverse communities.

Veterinary medicine navigating the language barriers with Spanish speaking pet owners

As demographic changes occur, areas of the United States that were once primarily monolingual are now more multilingual, with Spanish emerging as the most widely spoken language after English [14]. For veterinarians looking to expand their client base, focusing on enhancing communication with Spanish-speaking pet owners could be a valuable first step [14]. Effective communication is crucial in veterinary medicine, especially for Spanish-speaking pet owners with Limited English Proficiency (LEP). LEP refers to individuals who struggle to speak, read, write, or understand English well enough to interact effectively [15]. As the Latino population grows in the U.S., many pet owners face challenges in understanding medical instructions, medication regimens, and post-surgical care due to language barriers. Interestingly, even pet owners who speak

Spanish but understand English often prefer to receive their pet's health information in Spanish. For example, studies show that a significant number of English-proficient pet owners still want written materials in Spanish, highlighting the importance of offering bilingual resources [15] [9]. Even if someone is bilingual, they may still prefer to communicate in one language over another, particularly if it is the language in which they have the most cultural or emotional connection. This emphasizes that cultural competence in communication is not only relevant for those with limited English but also for those who are bilingual but still prefer to engage with medical information in their first language.

Research has shown that LEP pet owners are still likely to seek veterinary care despite the language barrier, but their experiences are significantly improved when communication is tailored to their language preferences [14]. To serve this demographic effectively, veterinary practices must incorporate bilingual services, translational tools, Spanish-language educational materials, and training for staff to address language barriers and ensure comprehensive care [16] [13] [17] [15]. By doing so, veterinary practices can foster better client relationships, improve patient care, and enhance business growth in linguistically diverse communities.

Preparing veterinary students to practice in a multicultural world

While cultural competence and implicit bias training are crucial aspects of veterinary education, these topics have historically been underemphasized compared to other healthcare fields [11]. Recent initiatives, such as the Competency-Based Veterinary Education (CBVE) framework by the American Association of Veterinary Medical Colleges (AAVMC), have begun to address this gap by providing guidelines for integrating cultural competence into veterinary curricula [11]. For example, Texas A&M Veterinary School has a medical Spanish course to help students communicate effectively with Hispanic pet owners [11]. Given the growing cultural diversity in veterinary clientele, it is essential for veterinary education to ensure students are equipped to practice in a multicultural environment, understanding how cultural and social factors influence health and pet care practices [18] [7].

Experiential learning opportunities, such as outreach clinics and service-learning programs, provide valuable opportunities for veterinary students to directly engage with diverse communities [7]. These programs teach students to adapt their communication styles, consider clients' social and cultural beliefs about pet ownership, and develop skills that will help them navigate complex client-practitioner dynamics [7]. Veterinary educators must prioritize cultural awareness and communication skills from the undergraduate level, providing a solid foundation for lifelong learning and professional growth. By doing so, students will be equipped to provide comprehensive, high-quality care for all clients, regardless of their background, leading to better health outcomes for animals and stronger relationships with the communities they serve.

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WEDNESDAY, APRIL 30, 2025 | 3:00 PM

GPT for DVM: How Language Models are Transforming Veterinary Medicine

ZACHARY MEYERS, DVM

Co-founder of LyraVet

Learning Objectives:

- Gain clinical understanding of Large Language Models (LLMs) and artificial intelligence
- Learn the established utility of LLMs in medicine
- Understand performance and privacy considerations for both practice-specific and generalized LLM solutions
- Learn to recognize and prevent hallucinations.

Disclosure: There will be mention of several different free and paid software services in this presentation and associated lecture notes. The author wishes to disclose that he is the co-founder of LyraVet, an AI based clinical workflow tool. He has no other professional affiliation or personal stake in any other companies/products mentioned.

Introduction and Foundation:

Large Language Models (LLMs) are a major advancement in artificial intelligence, and have taken the world by storm the past few years. LLMs are essentially sophisticated pattern recognition systems that can process and generate human language. Unlike search engines that simply retrieve information and traditional rule-based programming, LLMs can 'understand' context and create responses based on the massive amounts of data from which it was trained. This capability makes them particularly valuable for veterinary medicine, where complex clinical decision-making and administrative tasks are daily challenges.

LLMs Explained

Large Language Models (LLMs) learn patterns through a process that is superficially similar to human learning. During training, these models are exposed to vast datasets - often containing hundreds of billions of words - from which they learn statistical relationships between pieces of text.

The fundamental mechanism of an LLM is next-token prediction. A "token" can be a character, part of a word, or a full word, depending on how the model classifies sections of text. When you input "The dog chased the", the model isn't truly understanding the concept of a dog or its potential actions. Instead, it's using its training to calculate probabilities for what token should come next. In this case, tokens like “ball” or “cat” might have high probabilities based on the patterns the model has seen, while tokens like "accountant" or "agriculture" would have very low probabilities because they rarely or never follow that particular sequence in the training data.

This process is interactive with each prediction influencing the next. When the model predicts "ball" after "The dog chased the", this new context is then used to predict the next token, and so on. The model is constantly updating its probability distributions based on the accumulating context.

The sophisticated, dynamic, and complex learned patterns are responsible for the impressive intelligence of LLMs. Through their training, they've captured complex statistical relationships that mirror grammar, factual knowledge, logical reasoning, and even some aspects of common sense. However, unlike a veterinary student who develops genuine understanding through study, the LLM is performing an incredibly advanced form of pattern matching - it's making predictions based on statistical correlations in its training data, without truly understanding the concepts it's manipulating.

This is why LLMs can sometimes generate text that is perfectly fluent but factually incorrect- they're predicting what tokens often follow each other in their training data, not reasoning from a genuine understanding of the world. The model might confidently place tokens together in ways that are statistically likely but semantically meaningless, because it lacks true comprehension of what those tokens represent. Highlighting the incredible power and limitations of LLMs.

Current Landscape and Clinical Applications:

The current landscape of LLM platforms includes several major players, each with distinct capabilities. ChatGPT, Anthropic’s Claude, and Google's Gemini are all available for free with paid subscriptions for more advanced versions or higher usage. These models are trained on the vast contents of the internet and are not specifically tailored to veterinary medicine. However, that does not mean they are not clinically useful. Hirosawa et al. (2023) used the popular chatGPT-4 to create differential diagnosis lists which were >80% accurate (i.e. the correct diagnosis was listed). This is just one example of how even general purpose LLMs are clinically relevant and accurate.

Veterinary-specific tools have emerged to address industry-specific needs. Platforms like LyraVet and Vetsie incorporate specialized medical knowledge, prompt engineering, and practice integration features. These specialized solutions show particularly promising

results, our early data indicates up to 3x faster charting times and significant improvements in note quality. Anecdotally, I have noticed a palpable difference in client interaction and appreciation when leveraging these tools in the clinic.

Real-World Impact and Evidence:

Despite the recent explosion of AI there is already a wealth of research supporting LLM performance in medicine.

1. Recent research by Cao et al. (2024) demonstrates that AI-driven scribes can reduce documentation time by 22.7% while improving note quality and patient interaction, addressing a critical need in a field where practitioners spend a significant amount of time performing documentation.
2. Research from BMC Health Services indicates that practices implementing AI scribes see a 48% reduction in after-hours documentation work (Piersa et al. 2021). A powerful work-life balance tool.
3. chatGPT-4 has demonstrated its veterinary capability and knowledge by successfully 'passing' the NAVLE with a score of 89% (Angel et. al, 2023).
4. A comprehensive human medicine study by Piersa et al. (2021) found that median time to finish a patient appointment and complete their charting decreased from 1.2 to 0.4 days with AI assistance. The study also noted an 86.9% accuracy rate in objective documentation, suggesting that AI scribes can maintain high standards of clinical documentation while improving efficiency.

Critical Safety:

Understanding Privacy and security considerations are paramount when implementing LLMs in veterinary practice. Maintaining the Veterinary Client-Patient Relationship (VCPR) compliance requires careful attention to data handling protocols and information security. Specific best practices include **data sanitization before sharing with LLMs and utilizing appropriate security features within chosen platforms.**

A critical concern unique to LLMs is the phenomenon of hallucinations - instances where they generate confident but incorrect information. Although hallucination rates are relatively low, their potential impact necessitates robust verification protocols. Prevention strategies include proper prompting techniques and established cross-verification methods to ensure accuracy. See session two for additional information and strategies to avoid hallucinations.

Conclusion and Recommendations:

The integration of LLMs into veterinary practice represents a significant opportunity to improve clinical efficiency while maintaining or enhancing patient and client care.

Success requires a balanced approach that leverages technology's benefits while maintaining appropriate safeguards and human oversight.

Key recommendations for practices considering LLM implementation include:

- Start simple -Explore free ChatGPT and Claude
  - Ask it to create client handouts for complex yet common diseases (i.e diabetes, cushings, CKD).
  - Provide the details of your difficult case and ask for assistance in creating a treatment/diagnostic plan.
- Establish clear protocols for data privacy and security
  - Do not include any personal information in prompts.
  - Use veterinary specific LLMs for better data privacy.
- Maintain human oversight of all AI-generated documentation
  - Always review the contents generated by AI. **It will make mistakes -** it's the responsibility of veterinary professionals to ensure output is accurate.

As we move forward, the role of LLMs in veterinary medicine will likely continue to expand. However, these tools should be viewed as supplements to, rather than replacements for, clinical expertise. The goal remains to enhance the quality of veterinary care while improving practice efficiency and staff satisfaction.

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WEDNESDAY, APRIL 30, 2025 | 4:30 PM

AI in Your Practice: Getting Started with LLMs

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Co-founder of LyraVet

Learning Objectives:

- Understand the fundamental concepts of Large Language Models (LLMs) and their current capabilities in veterinary medicine.
- Introduce principles of prompt engineering for veterinary applications, including techniques for crafting effective prompts and understanding the importance of context and verification
- Identify and navigate the challenges of AI hallucinations in clinical settings, including development of verification protocols and best practices for ensuring accuracy
- Explore practical applications of LLMs in veterinary practice, with specific focus on:
    - Medical scribing and documentation
    - Diagnostic support and pattern recognition
    - Client communication and discharge summaries
- Develop strategies for effective human-AI collaboration in veterinary practice, understanding both the capabilities and limitations of AI assistance in clinical workflows

Disclosure: There will be mention of several different free and paid software services in this presentation and associated lecture notes. The author wishes to disclose that he is the co-founder of LyraVet, an AI based clinical workflow tool. He has no other professional affiliation or personal stake in any other companies/products mentioned.

Definitions:

- Large Language Model (LLM): An advanced artificial intelligence system that learns from vast amounts of written text, allowing it to understand and respond to questions, generate content, and assist with tasks in ways that mimic human communication.
- Model: Computer software that has learned to perform specific tasks through exposure to examples. The trained "brain" behind the AI software.

- Artificial Intelligence Medical Scribe: A digital assistant that listens to doctor-patient conversations and automatically creates medical notes in a standard format.
- Hallucination: A phenomenon where an AI system makes up information that sounds plausible but is factually incorrect, despite appearing confident in its response.
- Prompt: The specific question or instruction given to an AI system to get the desired response.
- Natural Language Processing: The ability of AI systems to understand and work with human language in its natural form, rather than requiring specific computer commands or codes.
- Chain-of-Thought Prompting: An advanced AI interaction technique where the model is guided to demonstrate its reasoning process step-by-step, improving the transparency and potential accuracy of its responses.

Introduction:

The landscape of veterinary medicine is undergoing a major technological transformation, driven by the emergence of Large Language Models (LLMs) that are poised to revolutionize clinical practice, documentation, and patient care. These artificial intelligence systems represent a paradigm shift in how veterinary professionals can process, analyze, and interpret complex medical information. There is tremendous value in knowing how to best leverage LLMs in the clinical setting. This lecture aims to give clinicians the information necessary, provide instructions, and discuss examples on how to best use LLMs.

LLM Technology in Veterinary Medicine:

Large Language Models have rapidly evolved from general tools to systems capable of nuanced medical interpretation to those who are prepared to leverage them. Wulcan et al. (2024) has provided an evaluation of LLM capabilities in medical information extraction. Their research focused on ChatGPT-4-Omni's performance in analyzing electronic health records (EHRs) for feline patients, revealing remarkable insights into the potential of AI in veterinary diagnostics. This is significant because chat-GPT-4 omni has not been specifically trained to perform veterinary tasks, demonstrating that even general LLMs are beneficial to veterinary medicine.

The study's most significant findings demonstrated extraordinary performance metrics in clinical information extraction of EHR for cats with chronic enteropathy. With a sensitivity of 96.9%, specificity of 97.6%, and a negative predictive value of 99.5%, the LLM demonstrated capabilities that approach or even exceed human-level accuracy in processing complex medical documentation (Wulcan et al., 2024).

Despite the promising results, the implementation of LLMs in veterinary medicine is not without challenges. The Wulcan study highlighted critical nuances in AI-driven information processing. Most notably, the model's errors predominantly occurred in scenarios where human reviewers themselves disagreed, underscoring the complexity of medical text interpretation. This finding emphasizes the need for sophisticated collaboration and continuous oversight by trained professional humans

Clinical Applications

The potential applications of LLMs in veterinary medicine extend far beyond simple information processing. These technologies could revolutionize multiple aspects of veterinary practice. The previous lecture discussed the demonstrated efficacy of LLMs in medicine, and we will now take on a more practical focus to demonstrate how these are actually used in veterinary medicine.

Medical Scribe:

Automated generation of comprehensive medical records, reducing administrative burden and minimizing human error.

Clinical demonstration (what does this look like in practice):

1. Disclose plans to record to clients
2. Turn on microphone and initiate recording
3. Perform exam as normal
4. Leave room and verbalize any unspoken information
5. Send recording to AI scribe
6. Read and edit the output.

Diagnostic Support:

LLMs are inherently pattern recognition machines, and they are capable of helping veterinarians identify subtle clinical indicators that might be overlooked. By analyzing vast amounts of medical literature and clinical data, these systems could provide (or at least assist humans in) nuanced diagnostic insights.

Case studies

- **Image Summarization for Lesions**
- **AI Tools for Cytology Interpretation**
- **Diagnosis DDx Generation**

Client Communication:

Advanced language models can generate clear, compassionate, and clinically accurate communication materials. From discharge instructions to detailed treatment explanations, LLMs can help bridge communication gaps between veterinary professionals and pet owners. Perhaps the most personally impactful use case for LLMs is the generation of client summaries that function as communication pipelines to further foster the VCPR through 'personalized' client content. AI can (ironically) be used to better forge personal relationships and demonstrate empathy. Anecdotally, many of my clients have expressed gratitude for their personalized, detailed, and/or empathetic discharge summary.

Prompt Engineering - The Critical Interface Between Veterinary Professionals and Artificial Intelligence

Prompt engineering is the strategic and nuanced approach to interacting with Large Language Models, serving as the primary mechanism through which veterinary professionals can steer LLMs toward better results. At its core, prompt engineering is the process of crafting input instructions that guide AI systems to generate precise, contextually appropriate, and clinically relevant outputs. **It's what we type into the LLM to get the best results.**

Effective prompt engineering involves understanding the intricate communication dynamics between human and computational intelligence. Unlike simple keyword searches or rigid commands, advanced prompting requires comprehension of both veterinary medical terminology and the underlying capabilities of AI models. Researchers like Maharjan et al. (2024) have demonstrated that carefully constructed prompts can dramatically enhance the performance of open-source language models, transforming them from generalist tools to specialized medical assistants.

Context is the cornerstone of successful prompt design in veterinary applications. A well-crafted prompt often incorporates multiple layers of information: specific medical context, desired output format, professional tone, and precise constraints. For instance, a prompt for generating a discharge note for a complex feline diabetes case might include specifications about the patient's age, concurrent conditions, treatment history, and the required level of detail for client communication. This multi-dimensional approach ensures that the AI-generated content is not merely technically accurate but also clinically meaningful and practically useful.

Advanced prompt engineering techniques extend beyond simple instructions. The emerging methodology of chain-of-thought prompting allows veterinary professionals to guide AI models through explicit reasoning processes. By requesting step-by-step explanations or decision-making frameworks, users can gain insights into the model's logic, verify its reasoning, and identify potential limitations, hallucinations, or biases. This

approach is particularly crucial in medical contexts where transparency and accountability are paramount. (Miao, 2024)

The iterative nature of prompting represents a dynamic interaction between human expertise and artificial intelligence. Veterinary professionals must develop a skill set that involves:

- Precisely articulating clinical scenarios
- Identifying and correcting model-generated inaccuracies
- Progressively refining prompts to improve output quality
- Understanding the limitations and potential hallucination risks of AI systems

Ultimately, prompt engineering represents an emerging competency for modern veterinary professionals as LLMs become further integrated into veterinary medicine. It requires a unique blend of clinical expertise, technological understanding, and communication skills. As AI technologies continue to evolve, the ability to effectively communicate with and leverage these systems will become an increasingly valuable professional skill.

Hallucinations:

All new technologies come with inherent risks, and it is important that all veterinary professionals using LLMs work to understand and mitigate potential risks. At the forefront of these considerations are hallucinations - a complex phenomenon where AI systems generate plausible-sounding but fundamentally incorrect information with an alarming degree of apparent confidence.

Recent research by Ji et al. (2023) highlights a particular concern in medical contexts - the combination of specialized terminology and potential health impacts makes hallucinations especially problematic in clinical settings. Their findings emphasize that when medical AI encounters ambiguous situations, it may generate coherent but incorrect responses that could impact patient care if not properly identified and managed.

To combat these challenges, veterinarians need verification systems that combine clinical expertise with technological tools. Building on Ji et al.'s (2023) proposed framework of iterative self-reflection and knowledge validation, veterinarians can implement several key strategies to detect and prevent AI hallucinations:

- Validate AI-generated information against current veterinary medical literature and guidelines
- Use a multi-source approach that draws on multiple references and expert opinions

- Develop systematic protocols for critically evaluating AI outputs before clinical use
- Create documented verification steps for reviewing AI-assisted documentation

This approach helps ensure that while veterinary practices can benefit from AI assistance, they maintain high standards of accuracy and patient care through careful oversight and verification processes. **All information should be validated by the filter that is a human veterinary professional.** Rather than viewing AI as an autonomous system, veterinary professionals should conceptualize these tools as sophisticated assistants that require continuous oversight and critical evaluation.

Privacy and data security emerge as equally critical considerations in the deployment of AI technologies within veterinary practice. The VCPR framework is an ethical and legal foundation to consider when implementing AI responsibly.

Best practices for data security in veterinary AI applications include:

- Anonymizing patient data in any AI prompts/training/etc.
- Obtaining explicit client consent for AI-assisted medical documentation.
- Utilizing established veterinary specific LLMs for better data security.
- Ensuring strict access controls and authentication mechanisms.

The landscape of AI safety in veterinary medicine is continuously evolving. Professionals must remain adaptable, continuously updating their understanding of technological capabilities and limitations. As the field progresses, the most successful veterinary practices will be those that can effectively balance technological innovation with rigorous professional standards.

Conclusion: A Collaborative Future

The integration of Large Language Models in veterinary medicine represents a collaborative journey between technological innovation and professional expertise. These tools should be viewed as powerful assistants that augment, rather than replace, veterinary professional judgment.

As the technology matures, we can anticipate increasingly sophisticated AI systems that will transform veterinary practice. The key to successful implementation lies in maintaining a balanced approach that prioritizes animal welfare, scientific rigor, and continuous technological refinement. Veterinary professionals who embrace these technologies strategically and ethically will be best positioned to leverage their potential, ultimately improving patient care and advancing the field of veterinary medicine.

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WEDNESDAY, APRIL 30, 2025 | 9:00 AM

Dermatology Tests for Everyday Practice

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INTRODUCTION

Protocols are useful in helping to diagnose and treat many different disorders. Part of any good protocol should be a minimum data base (MDB). In addition to signalment, history, etc in veterinary dermatology, laboratory testing should be a component of this data base. Just as you may have a standard set of tests for diarrhea you should have a standard set of tests for dermatology cases. Because practitioners get busy, sometimes collection of this minimum data base is overlooked. By training technicians to perform the tests this potential problem can be avoided. Instructing technicians to perform these tests on every pruritic animal ensures that this will be done on every case.

Tests can be separated into immediate and delayed tests. For a pruritic dog or cat all the immediate tests should be performed. Which of the delayed tests should be performed will varying based on the results of these tests.

Immediate tests include

1. Skin scrapings **
2. Impressions smears **
3. Ear cytologies ** if ear disease is present
4. Fine tooth combing **
5. Hair plucks/trichograms

Delayed tests would include

1. Skin biopsies
2. Woods lamp and fungal culture
3. Bacterial culture and susceptibility
4. CBC, serum chemistry profile and urinalysis
5. Adrenal function tests
6. Thyroid profile
7. Dietary elimination food trial
8. Intradermal testing (or serum testing) and allergen specific immunotherapy

***** Component of MDB***

EQUIPMENT

The equipment needed is very basic and include

1. #10 scalpel blade- dulled by scratching the frosted part of a glass slide
2. Mineral oil
3. Frosted glass slides and cover slips
4. Clippers
5. Microscope
6. Minitip culturettes
7. Needle and syringes
8. Woods lamp +/- derm duet
9. Punch biopsy
10. Lidocaine/bupivicaine/sodium bicarbonate

SKIN SCRAPING

Let's begin with skin scrapings. Before performing skin scrapings you should ask the following questions

1. What technique do I use (broad superficial or deep scrapings or both)
2. Where do I need to skin scrape?
3. What lesions should be scraped?

The answers to these questions depend on which parasite you suspect. If you suspect a superficial mite (*Sarcoptes, Notoedres, Demodex gatoi (*cats), *Demodex cornei* (dogs) *Cheyletiella*) then broad superficial scrapings should be performed. Deep skin scrapings should be performed when *Demodex canis or cati* is suspected. (Table 1)

When performing superficial scrapes be sure to scrape from appropriate areas. For *Sarcoptes* you will be more successful if you scrape pinnal edges, the elbows, ventral chest and hocks. In addition any popular, crusted or erythematous lesion should be scraped.

For any of the superficial mites, broad scraping should be performed. Remember that mites associated w/hypersensitivity (eg *Sarcoptes*, *Cheyletiellai*) may be difficult to find due to their low numbers so be sure to take multiple (10-15) sites. In contrast to demodex, all scrapes can be placed on 1 or 2 slides because the quantity of mites present is not important, they are either found or not.

When performing a deep skin scrape for demodex (this applies mostly to dogs) there are a few pitfalls to avoid. By avoiding these errors the diagnosis and your management of demodex will improve.

These include

1. Failure to squeeze the skin prior to scraping. Squeezing helps express the *Demodex* from the hair follicles
2. Failing to record location of scrapes;
3. Failing to record numbers & stages present;
4. Failing to record whether the mites are alive or dead;
5. Failing to clip hair at skin scrapings sites (if it is a recheck appointment, the hair may be regrowing preventing proper sample collection);
6. Failure to squeeze the skin prior to scraping to try
7. Failure to recognize that lesions that are granulomatous & fibrotic, especially on the paws may have demodex that are hard to demonstrate on skin scrapings and a skin biopsy may be necessary to diagnosis;
8. Failure to sedate dogs if the feet are to be scraped
9. Failing to scrape hyperpigmented areas even if they are not alopecic;
10. Failing to scrape areas with comedones even if they are not alopecic
11. Failing to scrape if a dog only has greasy seborrhea (especially along the dorsum). A long body type of demodex mite has been identified *(Demodex injai*). This mite lives in the sebaceous glands of the dog's skin, and thus, is commonly associated with "greasy coats" rather than the moth eaten or pustular appearance that we are used to seeing.
12. Failing to take broad superficial skin scrapes even if demodex is the only parasite you suspect. There is a short bodied demodex mite (*Demodex cornei*), which lives on the surface of the skin layer. Note that there may be a low number of these mites found because of the superficial location of the mites allowing removal by the animal.

CYTOLOGY

Cytologic examination is another very commonly performed procedure in dermatology that should be performed on any dog or cat presented w/skin or ear disease. Cytology is used to identify the presence (and/or type) of:

1. Bacterial or fungal organisms (*Malassezia*);
2. Neoplastic cells;
3. Inflammatory cells;
4. Abnormal cells (eg acantholytic keratinocytes associated w/pemphigus foliaceus)

When the skin is scaly, a superficial skin scraping can be useful. A very small amount of mineral oil is placed on a #15 scalpel blade to help keep the scale on the blade once it has been collected. The lesion is scraped a few times, and the material collected is placed on a microscope slide, stained (see below about staining samples), and examined microscopically at 40X and 100X.

Direct smears can be collected by a variety of ways.

Impression (touch) smears are useful when there is an erosion, ulcer, crust, moist or greasy lesion. To perform an impression smear, a slide is firmly applied to a lesion and, in most cases, is then gently moved back and forth a few times to increase the yield. Some people will use slides that are "sticky" on one side. These slides are reported to increase the yield of sample collected but the author finds that a standard slide works quite well. The slide is then processed and examined as described below.

If the lesion is fluid filled (eg pustule, papule) but is too small for a fine needle aspirate, "lance" the lesion with a 25 gauge needle, gently squeeze the lesion and then do an impression smear of any material expressed. When sampling crusts, lift the crust and rub both the underside of the crust and the surface of the skin.

Roll smears (swabs) are used when it would be difficult to get a slide into the affected area. This could be the face fold, the interdigital space on cats and small dogs and the ear canals in all dogs and cats. A cotton tipped applicator is gently rubbed back and forth across the lesion and then the material from the applicator stick is rolled back and forth on the slide. If the lesion is scaly, applying a small amount of mineral oil to the swab can help with collection. The sample is rolled onto a microscope slide, stained and examined as previously described.

A fine needle aspirate is performed when a solid or fluid filled mass or lesion is present. A 22-25 gauge needle attached to a 12 cc syringe is placed into the lesion and suction is applied by pulling back the plunger of the syringe (½ to ¾ of the way). The syringe plunger is pulled back and released a few times. Don't aspirate aggressively enough that you get blood contaminating the sample (you should not see blood in the hub of the needle). After aspirating one spot, stop aspirating and redirect the needle in the mass w/o pulling out and repeat the aspiration. This can be repeated 2 or 3 times on each sampling attempt. The needle is disconnected from the syringe, the syringe is filled w/air and the needle is placed back on the syringe. The material is then ejected from the needle by compressing the plunger. If the lesion is a fluid filled you only have to pull back far enough to get a sample into the syringe. Note- Measuring and noting the location of the masses is valuable for monitoring progression and/or response to treatment.

Regardless of the collection technique (except when using the tape prep) historically the author would heat fix the sample, using a cigarette lighter, and then wait a minute or so to allow it to cool. The slide was then stained w/a modified Wright stain (Diff Quik®). There are 3 jars in the Diff Quik® kit. The first jar is a fixative containing methanol, the second contains buffered xanthene dye, which stains the cells and organisms red and the third contains a buffered thiazine dye (methylene blue) which stains the cells and organisms purple. After drying, the slide would then be examined.

A more rapid and equally effective method is to bypassed both the fixative step and the second step (eosin) and directly go to the 3rd step using the methylene blue only. It doesn't appear to hinder the identification of bacteria, yeast or inflammatory cells except for eosinophils. If using the tape prep I will put a drop on stain on the slide and then place the tape, sticky side down, over the stain and examine.

Ear cytologies are performed to identify mites, infectious agents and inflammatory cells. A cotton tip applicator is used to collect the samples prior to instituting therapy. Results of the cytology help direct appropriate therapy (presence of infectious agents would indicate the need for antimicrobial therapy). I will also perform ear cytologies during therapy if either the ear(s) are not responding to treatment OR if there were rods or WBC's or nuclear streaming on the initial cytology regardless of the appearance of the ear. If the initial cytology revealed yeast and/or cocci and the looks normal at the recheck examination I don't cytology it since I don't expect to sterilize the ear canal- in fact the treat for eliminating certain bacteria (eg enterococcus) may be just discontinue the antibiotic and allow restoration of the normal microbiome.

A few tips when examining your sample.

1. For skin cytologies
a. For bacteria look in 10 fields and record a range (eg 0-5, 5-10, 10-20 etc) – be sure to note if they are cocci or rods, if WBC's or nuclear streaming are present or not and if the bacteria are intracellular or extracellular
b. For *Malassezia* look in 20-25 fields (unless they are ID sooner). Report them as negative/+0 if NO *Malassezia* is found, +1 if 1 or 2 organisms are found (total #) in all the fields examined and there were never more than 1 in a field, report a +2 if there are more than 1 organism in a field or 1 organism q 3-4 oil fields – treat any case w/a +2 and consider treating even if +1. In fact the ACVD now recommends either reporting *Malassezia* as either present or absent.
2. For ear cytologies
a. There is no universal agreement as to what are normal number of cocci or *Malassezia* from an ear cytology
1. Because the host reaction to the organism is as important as the number, ANY organism seen in a diseased ear will be treated as part of the therapy regardless of the number present
b. Inflammatory cells or rod shaped bacteria are never present in a normal ear.

FINE TOOTH COMBING

Combing of the hair with a fine tooth comb ("flea comb") is a method that can be useful in finding fleas and other ectoparasites (ticks, lice and *Cheyletiella).* You may also detect military lesions on cats that were not appreciated on your physical examination.

TRICHOGRAM ("HAIR PLUCKS")

Veterinarians are frequently presented w/animals that have hair loss. In establishing the diagnosis of the hair disease, signalment, history (constitutional signs present or not?) and physical examination (eg pot belly, enlarged liver, etc) are important components in establishing a diagnosis. There are times that even w/this information the cause of the alopecia has not been established. A trichogram, which is a microscopic evaluation of plucked hairs, may be a useful tool to help identify the underlying cause.

If the alopecia is self induced (pruritic) or due to fragile hairs (eg dermatophytosis) the distal end of the hairs will be broken (or if the dog/cat gets haircuts). If the hair loss is spontaneous (eg endocrinopathy) the tips are tapered.
Hair plucks can also be useful in ruling in (but not ruling out) demodicosis. Other ectoparasites may also be identified such as *Cheyletiella* or lice.

Follicular cast can also be identified w/hair plucks. Follicular casts refers to the accumulation of keratin debris that adheres to the hair shaft as it extends out of the hair follicle. This finding indicates a follicular keratinization disorder which occurs w/vitamin A responsive dermatosis (rare- but if occurs would be a Cocker Spaniel most likely), follicular infections (demodex, dermatophyte, bacterial), *Malassezia* dermatitis, sebaceous adenitis, endocrinopathy (hyperadrenocorticism, hypothyroidism) or primary seborrhea such as ear margin seborrhea.

SKIN BIOPSIES

Skin biopsies are an easily performed outpatient procedure. The author will perform a skin biopsy for:

1. Any skin disease that is not responding to what should be effective therapy;
2. Any skin disease that may be potentially neoplastic;
3. Any skin disease that may be a cutaneous marker for a systemic disease (eg hyperkeratotic footpads associated with metabolic epidermal necrolysis);
4. Any skin disease that may be autoimmune or immune mediated;
5. Any nodular disease;
6. Any skin disease that appears unusual;
7. Any skin disease that requires expensive or potentially toxic therapy

The 2 methods used to biopsy the skin are the punch technique and the elliptical, incisional biopsy.

For punch biopsies, the author usually will use a 6 mm punch biopsy instrument. When using this instrument, DO NOT include normal tissue in the sample- only the lesion. If biopsying the edge of a lesion then perform an incisional biopsy.The author uses elliptical, incisional biopsy with a scalpel blade for lesions that are alopecia, ulcerated, erosive or are suspected to involve the subcutaneous tissue (eg panniculitis). For

subcutaneous lesions, a punch sample may not get subcutaneous tissue and therefore may miss important lesions. This type of biopsy has one end of

the sample in normal tissue and 1 end in the middle of the abnormal. The biopsy should be elliptical and request the laboratory to section the sample from tip to tip. This technique allows the evaluation of the formation of the lesion- from normal to very affected skin- it allows a "story to be told" about the lesion

Sites should NOT be shaved or scrubbed prior to collection since this may remove very valuable information. The hair may be partially clipped to visualize the lesion better, but in order to avoid traumatizing the skin, at least ¼ inch length of hair should remain.

BACTERIAL CULTURES

In the past, bacterial cultures were not frequently performed in dogs with skin disease since *Staphylococcus intermedius* was the most common bacterial pathogen and had a predictable susceptibility profile. Unfortunately it isn't that simple any more. *Staphylococcus intermedius, Staphylococcus pseudintermedius*, *Staphylococcus lugdunensis* or *Staphylococcus delphini Staphylococcus schleiferi* subsp. *Schleiferi*, *Staphylococcus schleiferi* subsp. *coagalens,* and *Staphylococcus aureus* all w/variable susceptibilities (methicillin resistant, multidrug resistant, combination) are now associated w/pyoderma in dogs. The need for bacterial culture and susceptibility testing in the dog or cat has become more frequent. Indications for bacterial culture would include the presence of:

1. Nodules;
2. Deep draining tracts;
3. A bacterial infection of the skin (confirmed by identifying intracellular bacteria and degenerative neutrophils) that fails to respond to appropriate antibiotic therapy;
4. Suspicion of an uncommon bacterial infection (atypical mycobacteria, nocardia, actinobacillus);
5. Suspicion of an anaerobic infection (gas pocket formation);

Before performing a bacterial culture be sure that you performed a cytology on the sample and identified neutrophils and cocci bacteria. If not reconsider your diagnosis (eg pemphigus?)

If a c/s is submitted, before evaluating the susceptibility of the organism be sure that you isolated one of the previously mentioned staphylococcus organisms. If not reconsider your diagnosis. If a culture is submitted be sure the laboratory is using the MIC (broth microdilution technique) method should be used to determine the susceptibility rather than the disc diffusion method (Kirby-Bauer). The disk-diffusion susceptibility test (DDST) is semiquantitative in that the drug concentration achieved in the agar surrounding the disc can be roughly correlated with the concentration achieved in the

patient's serum. It will only report the organism's susceptibility (susceptible, intermediate or resistant) based on an approximation of the effect of an antibiotic on bacterial growth on a solid medium. Tube dilution (MIC) is quantitative, not only reporting SIR but also the amount of drug necessary to inhibit microbial growth. It is reported as the amount of antibiotic (in µmg/ml) necessary to inhibit the growth of the tested bacteria (the lowest concentration in the tube that is clear). This allows a clinician to not only decide susceptible or resistant but also the proper dosage and frequency of administration of the antibiotic. Please be aware that a susceptible designation alone does not necessarily imply efficacy. Other factors as such as the location of the infection and the immunologic status of the host are also determining factors in the ability to clear an infection. The advantage of the MIC method is that not only does it indicate susceptibility, but it also implies the relative risk of emerging resistance and thus the need for a high dose.

To interpret and use a susceptibility test based on MIC requires the following information

1. MIC of the antibiotic in relationship to the organism. This is reported on the culture results.
2. Breakpoint MIC or in other words at what concentration is the bacteria consider susceptible (if the MIC is lower than this value) or resistant (if the MIC is higher than this value). This value should be available from your laboratory. Currently MSU's DCPAH website has a breakpoint chart available (see below for chart or go to *www.dcpah.msu.edu/sections/bacteriology/WEBCD.BACT.REF.011*)
3. You then look at the culture results and list all the antibiotics that are reported as $\leq$ X where X can be any number
4. For the next step you need to be aware that within a population of susceptible bacteria there is a mixture of strains (heterogeneity). Some of the strains are very sensitive to a given antibiotic while others are less susceptible. The less susceptible ones would be the ones w/the MIC closer to the breakpoint (resistant MIC level). From the list you made in step 3 you need to rank the antibiotic based on which have the most susceptible bacteria. You do this by calculating the efficacy ratio. This number is the breakpoint of the antibiotic divided by the MIC of the bacteria. The higher the number the more susceptible the bacteria is to that antibiotic.
5. You will need to take the list from step 4 and decide which antibiotic fulfills your needs based on
    a. High efficacy ratio
    b. Ability to penetrate the infected tissue
    c. Side effects of the drug
    d. Ease of administration (consider both route and frequency required)
    e. Cost of the medication
6. If there are no antibiotics w/ $\leq$ X or the ones that do are either too toxic or too expensive you should then look at the remaining antibiotics that are reported as susceptible. From this list you need to calculate the efficacy ratio. Remember this number is the breakpoint of the antibiotic divided by the MIC of the bacteria. The higher the number

the more susceptible the bacteria is to that antibiotic. For example if you have a staph bacteria that has a MIC of 1 umg/ml to enrofloxacin and has a MIC of 4 umg/ml to

cephalexin. Which antibiotic is the population of bacteria most susceptible to? To determine this you take the breakpoint of enrofloxacin (4) and divide it by the MIC (1) and the efficacy ratio is 4. Doing the same to cephalexin you get (32/4) 8. Remember the higher the number the more susceptible the bacteria is to that antibiotic. So cephalexin would have the highest number of susceptible bacteria

7. With this list of antibiotics and their efficacy ratio, apply the criteria listed in step 5 to determine the most appropriate antibiotic
   Samples from a pustule or intact nodule should be used for culturing however, if an intact pustule is not available, culturing an epidermal collarette has also been shown to be reliable for sampling a SBF[xiii]. Use a mini-tip culturette to sample a draining tract or collect a macerated tissue sample if you are culturing a deep bacterial pyoderma or a nodule.

In the past oxacillin was used to identify all methicillin resistant staphylococcus (MRS). If the staphylococcus was a MRS then it would be resistant to ALL of the beta lactams. The incidence of methicillin resistant *S. pseudintermedius* (MRSP) has been increasing over the last decade[xiv] eliminating treatment using common antibiotics. Complicating management of MRSP is that these bacteria are frequently multi-drug resistant (MDR). In a study by Bemis, et al[xv] it was found that more than 90% of the MRSP were MDR. MDR was defined as being resistant to $\geq$4 additional antimicrobial drug classes. The cause of the increased frequency of MRSP has not been clearly established but one of the many risk factors for MRSA and MDR staphylococcus is the administration of fluoroquinolones. Reducing the administration of antibiotics and particularly fluoroquinolones and 3rd generation cephalosporins may help prevent persistent carriage of MRSA in humans.[xvi,xvii] In humans the overuse of third-generation cephalosporins for long periods has caused MRSA outbreaks.[xviii] Additional information about the administration of 3rd generation cephalosporins or fluoroquinolones is discussed below.

The new protocol for identifying MRS in humans is to use cefoxitin. In humans the organism is *Staphylococcus aureus*. In animals the staphylococcus responsible for infection usually belongs to the staphylococcus intermedius group (*S. intermedius, S. pseudintermedius*, and *Staphylococcus delphini*). The problem is that certain strains of methicillin-resistant *S pseudintermedius* (any in the SIG?) may be falsely identified as methicillin susceptible if the laboratory uses cefoxitin susceptibility as the indicator. This is because cefoxitin may not induce the *mecA* gene as reliably in *S pseudintermedius* as it does in *Staphylococcus aureus*. The most recent protocol is that oxacillin susceptibility testing should be retained for *S pseudintermedius* isolates (all SIG?) and that the break point is lowered from the previous level of 2.0 umg/ml down to 0.5 umg/ml. How is this clinically important? If you are using a human laboratory or a local laboratory they may

not be aware of this difference in testing between *Staphylococcus aureus* and *S pseudintermedius*. Because of this, the author strongly recommends using a veterinary laboratory that uses Clinical and Laboratory Standards Institute (CLSI) guidelines AND is aware of and has current knowledge of veterinary pathogens. Recently the effectiveness of clindamycin against MRSA has been questioned[xix]. There are 2 genes, *msrA* and *erm* that are responsible for *S.aureus'* resistance to macrolides (eg erythromycin). The *msrA* gene accounts for the resistance to only macrolides, while the *erm* gene codes for macrolides and lincosamides (lincomycin and clindamycin) resistant. The *erm* gene may be constitutive which means that it will be present in the bacteria from the onset and the culture will report resistance to clindamycin. It may be inducible in which case the MRSA will be susceptible initially to clindamycin and therefore reported as such. When MRSA has the inducible gene, resistance to clindamycin will develop WHILE on treatment. As the susceptibility pattern to clindamycin of MRSA isolates possessing the *msrA* gene (truly susceptible to clindamycin) or the inducible *erm* gene (potentially resistant) are the same, it is important to distinguish between these phenotypes. This is accomplished by an additional culture technique called the Double-disc diffusion D-test. This test will detect the occurrence of the inducible *erm* gene. Since no commercial lab is currently doing this additional culture, resistance to erythromycin may be used as a clue to this inducible gene. This is because the *msrA* gene and the *erm* gene both encode staphylococcus resistance to erythromycin. So if the staphylococcus is resistant to erythromycin, there is a potential for the inducible *erm* gene to be present. In the study by Rich et al, 97.3% of erythromycin-resistant isolates of MRSA were truly resistant to clindamycin despite only 25.5% demonstrating clindamycin resistance by routine laboratory testing. Therefore based on this study it would be prudent to avoid clindamycin in all *Staphylococcus aureus* infections that report resistance to erythromycin. In a 2009 study, inducible clindamycin-resistance was present in only MRSA isolates NOT in MRSP[xx]. The authors of the study concluded that since inducible resistance was not identified in any of the MRSP the use of clindamycin was a reasonable option for MRSP infections. Unfortunately, a subsequent study in 2010 did identify inducible clindamycin gene in 2 strains of MRSP[xxi]. In 2011 inducible clindamycin resistance was identified in MSSP and methicillin susceptible *Staphylococcus aureus* (MSSA). Because of these studies the author will avoid clindamycin in any staphylococcus infection, regardless of the species and strain, if the organism is reported to be resistant to erythromycin.

In infections with MRSP or methicillin susceptible *Staphylococcus pseudintermedius* (MSSP), resistance to tetracycline is mediated by 2 genes, *tet(K)* and *tet(M)*[xxii]. Resistance to tetracycline but not doxycycline or minocycline is mediated by *tet(k)*, while *tet(m)* will confer resistance to all 3 members of the tetracycline family. Complicating the issue is that if a MRSA organism (at this time it is unknown whether this is true for MRSP) has the *tet(k)* gene, exposure to either tetracycline or doxycycline can induce

doxycycline resistance thereby leading to clinical failure of doxycycline. This inducible resistance doesn't occur with minocycline. This has lead to the recommendation that MRSA infections that are resistant to tetracycline should be considered resistant to doxycycline regardless of the *in vitro* test result. In cases of tetracycline resistant MRSA infections, minocycline should be tested since if the *tet(m)* gene is present minocycline will be ineffective but if only the *tet(k)* gene is present, minocycline would be effective[xxiii.xxiv]

A few tips when dealing w/a bacterial culture (see table 1 for more details)

1. Use a Mini-Tip Culturette (Becton Dickinson Microbiology Systems) to pin point the sample
2. Taking samples from 2 or 3 lesions (if possible) will increase the likelihood of identifying all pathogens
3. Do cytology concurrently
4. When selecting a lesion to culture – from best to worse - pustule >papule>crust>epidermal collarette
5. If you are sampling a crust- lift the crust and swab the underside of the crust and the surface of the skin under the crusts with a the culturette.
6. For an epidermal collarette lift the edge of the collarette- if you are not able to do this then clip the hair w/scissors to expose the collarette then take a the culturette swab and gently roll it across the collarette 3 to 4 times.
7. Have the lab do susceptibility testing use the tube dilution (MIC) rather than disc diffusion (Kirby-Bauer)

Table 1. Sampling techniques for lesions of superficial bacterial folliculitis for bacterial culture and susceptibility testing

Lesion	Sampling procedure
Pustule	No surface disinfection. Clip hair with sterile scissors (avoid clippers). Lance pustule with sterile narrow-gauge needle. If purulent exudate is visible on the needle, apply to a sterile swab; if not, gently touch exudate expelled from pustule with sterile swab and place in transport medium or sterile container. Sometimes lancing of very small pustules results in haemopurulent exudate, which is still suitable for sampling
Crust	No surface disinfection. Use sterile forceps or a sterile needle to lift the edge of a crust. The presence of exudate under a crust indicates an ideal site for culture. Touch sterile swab to exposed skin surface and place in transport medium or sterile container
Epidermal collarette	No surface disinfection. Clip hair with sterile scissors (avoid clippers). Roll sterile swab across border of collarette two or three times and place in transport medium or sterile container[74]
Papule*	Sampling by biopsy is probably more reliable. Provide local anaesthesia by subcutaneous injection of 2% lidocaine. Clip hair with sterile scissors or clippers. Clean skin surface by a single wipe with 70% alcohol† (no additional surgical preparation). Allow alcohol to dry. Using a sterile 3 or 4 mm punch and sterile surgical instruments, collect tissue sample and place in sterile container or transport medium. Suture biopsy site Alternatively, papules may be prepared and disinfected† as above, then sampled by insertion of a sterile needle and culture of emerging or expressed blood or exudate

*There is no research to show which method is more appropriate.
†This method of disinfection is suggested to kill any surface bacteria. However, there is no research to indicate the value or necessity for any disinfection of the skin surface prior to sampling of papules.

DIAGNOSIS OF DERMATOPHYTES-consensus statement[xiii]

Dermatophytosis is diagnosed by utilizing a number of complementary diagnostic tests, including Wood's lamp and direct examination to document active hair infection, dermatophyte culture by toothbrush technique to diagnose fungal species involved and monitor response to therapy, and biopsy with special fungal stains for nodular or atypical

infections. PCR detection of dermatophyte DNA can be helpful; however, a positive PCR does not necessarily indicate active infection, because dead fungal organisms from a successfully treated infection will still be detected on PCR, as will noninfected fomite carriers. Negative PCR in a treated cat is compatible with cure. Negative fungal culture from a cat with no lesions and a negative Wood's lamp (except for glowing tips) is compatible with cure.

WOOD'S LAMP EXAMINATION AND FUNGAL CULTURE FOR DERMATOPHYTES

Dermatophyte infection is a common problem in cats and young animals of all species. Proper collection of the specimen is critical in identifying this infection. The first step is to examine the animal with a Wood's lamp. You should let the Wood's lamp warm up for at least 10 minutes, and then shine the light on the hair coat looking for apple-green glow to the entire hair shaft. Remember crusts may glow as may some topical medications. A positive test is suggestive of dermatophytes, but you need to culture the hair to confirm this. Please note that a negative test does not rule out dermatophytosis, in fact you should only use the lamp to guide in selecting hairs to pluck for culture not as a tool to rule out dermatophytosis.

Prior to collection, the suspected skin lesion should be gently cleaned if grossly contaminated. Mild soap (not antimicrobial) and water may be used. Allow the site to dry before collecting the sample. Using a sterile hemostat, you should pluck the hairs near the base so that you can get close to the bulb. Also scrape a small amount of scale/crust from the edge of the lesions. This will increase the success rate of identifying dermatophyte infections. If there are diffuse lesions or you are screening a cat for infection, a Mackenzie toothbrush method is used. To perform the toothbrush method, take a sterile toothbrush and rub it over the entire lesion from the margins to the center. Then take a sterile hemostat and remove the hairs/scale from the tooth brush and inoculate the culture plate.
Once a media is inoculated, close the cover and place the culture plate in a plastic bag or "pencil box" with a sponge to prevent dehydration of the media which can inhibit growth of organisms. In contrast to previous recommendations the sample does not need to be placed in a darkened area and it doesn't need to be incubated- it should be left at 77-86^{O} F. PUT IT IN A PLACE WHERE IT WILL BE EXAMINED DAILY.

If submitting to a reference lab, just take the sample and place it in a red top tube and send that to the reference lab.

If you are doing the culture in house, be sure to check it DAILY and record the findings. It is important to note when the media changes color w/respect to colony growth. A large

amount of growth w/small color change (contaminant) is interpreted differently than a small amount of growth & large color change to RED (dermatophyte). The color of colony is important in determining contaminant vs. dermatophyte, as is microscopic examination of macroconidia. To get the sample for microscopic examination, apply sticky side of clear acetate tape to the culture media where the growth has occurred. Then stain the sample with Lactophenol cotton blue By microscopically examining the sample you can speciate the dermatophyte. By speciating the dermatophyte you can tell the source of the infection (see below). This is done by identifying macroconidia. The descriptions of the different macroconidia are available in many text books or on line. [xiv]

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WEDNESDAY, APRIL 30, 2025 | 10:00 AM

Facilitating Food Allergy Diagnosis: A Guide for Veterinary Technicians

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This lecture will address how the Veterinary team can implement an effective diagnostic diet trial for patients who may benefit from them. Currently, a dedicated diet trial is the gold standard for diagnosing food allergies correctly. Ongoing investigations and new testing alternatives could change these guidelines; most likely, those alternatives will aid in the diagnosis but will not avoid the necessity for diet trials and challenges entirely. (1,2,3)

Food allergy is a recognized entity in canine patients and is caused by a triggering allergen in dietary components; according to the available studies and literature, the most common allergens are animal proteins such as beef, chicken, fish, eggs, and dairy. The prevalence of the most common allergens can vary depending on feeding customs and the type of foods the dog is exposed to. New research has identified allergens for dogs in common proteins such as beef and chicken; this could eventually lead to new types of testing to help in the diagnostic process of food allergy. (4,5)

Food allergies in dogs provoke clinical symptoms such as pruritus, otitis, erythema, papules, secondary infections (bacterial or yeast), and chronic skin lesions such as alopecia, hyperkeratosis, and hyperpigmentation. Some dogs present with more severe reactions, such as angioedema and urticaria. Other less common dermatological presentations may also occur. Non-dermatological symptoms primarily involve gastrointestinal issues, such as diarrhea, vomiting, borborygmi, flatulence, and increased frequency of bowel movements, with rarer respiratory symptoms. (6,7)

To accurately diagnose food allergy in dogs, a dedicated diet trial is necessary, and this involves feeding an exclusive diagnostic diet for eight weeks, followed by a provocative challenge.

Guidelines:

Diagnostic process-

1. Conducting a thorough clinical history is crucial; this involves reviewing the patient's medical background, the progression of their condition, and all prior treatments and outcomes. Effectively assessing the clinical history requires asking the right questions in the right way and identifying pertinent details, a process that demands both skill and practice; important questions include when skin or GI issues arose initially, and defining when itching was initiated will help get a better idea of the clinical presentation of the patient.

2. Questions about nutrition and gastrointestinal health should be included in the process. Using a routine or questionnaire can enhance the quality of the clinical history by ensuring no key questions are overlooked and avoiding distractions caused by the owner's input. Since feeding and nutrition are often personal topics for clients, it's important to approach the subject carefully. Asking open-ended questions, maintaining a positive and non-judgmental attitude, and actively listening are valuable skills in this context.

3. Canine atopic dermatitis will present clinically similarly in patients regardless of the triggering cause of the reaction (food vs environmental allergens).

4. As mentioned, testing for food allergy is not considered reliable. Some patients might have undergone food allergy testing, which can confuse the pet owner and require additional information to implement a diet trial.

Correct patient selection for initiating a diet trial.

Based on the clinical history and the physical exam, the clinician will decide to start a diet trial; here are some indicators for patient selection:

a) Non-seasonal clinical symptoms or patients that show exacerbation of their clinical signs by ingesting dietary ingredients.
b) Dogs presenting dermatological and/or gastrointestinal clinical symptoms in their first year of life or older. Dermatologic problems occur along with other gastrointestinal signs such as more than three daily bowel movements, eating grass, sometimes vomiting, belching, and borborygmus.
c) Dogs that present with recurrent otitis with no other abnormalities and where other causes have been ruled out should go into a food trial.

Owner considerations

Compliance is the biggest challenge when recommending a diet trial; owners' knowledge and understanding will weigh heavily on the diet's success. Some owners may refuse or be unable to conduct a food trial. This can occur for various reasons, and the veterinary team should identify those owners who fall into this category. It is not beneficial to initiate a diagnostic diet trial in situations that are likely to fail, as it can lead to frustration, wasted time, and sometimes the loss of the client. If necessary, the patient will begin treatment to manage itching and any secondary infections. Some owners need time to decide whether to start a diet trial. Providing them with options can be a very positive alternative. (8,9,10)

Managing skin and pruritus

Most patients requiring a diet trial present with clinical symptoms that need management. Pruritus, even in dogs without skin lesions, can significantly impact the quality of life of the dog and its owner, so it must be addressed. The clinician will select a systemic medication to control symptoms for a few weeks; the duration of these medications will depend on the individual's needs. Topical therapy and flea prevention will also be necessary, and should also be tailored to that individual's needs.

Diet selection for a food trial

Diet selection can sometimes be challenging; this can be related to the owner's food ideology or preference, the patient's medical needs, feeding preferences, finicky eaters, or dogs that will not eat a commercial diet.

The following are dietary options for a diet trial, and the veterinary team should have enough knowledge of the advantages and limitations of each of the diet options available for each patient.

Elemental amino-acid-based diet.

This diet is the lowest allergenic diet available. It is not made from a parent protein but from free amino acids and purified carbohydrates. It is a diet with high digestibility and a complete and balanced diet for dogs, including puppies.

Hydrolyzed diets

Hydrolyzed diets have been available to dogs for a long time. There are various reasons to use hydrolyzed diets over single protein diets, but the clinician's and the owner's personal preferences can play a role in diet selection. Veterinary-grade hydrolyzed diets undergo high-quality control and take extensive measures

to prevent other ingredients that could result in unlisted proteins or ingredients, making the diet choice less reliable. Another advantage is that hydrolyzed diets are complete balanced, and convenient to use. Patients with gastrointestinal disturbances can benefit from the digestibility of a hydrolyzed diet. Some

disadvantages to remember are that hydrolyzed diets have poorer palatability than others; some owners will struggle with diet acceptance and compliance, and the cost can also pose a limitation when recommending these diets.

Novel ingredients diets or single protein diets

Over-the-counter diets with novel proteins have been demonstrated to contain non-declared ingredients and are not a good option for performing a diet trial. There are prescription-grade diets with single protein options where care is taken to avoid contamination. In the current market, there is a wide variety of new diets; it can be hard to keep up with all the commercial options, which will vary from geographic location.(11)

Home prepared diets

Sometimes, a home-prepared diet can be necessary because of the owners' or the clinician's preference. When choosing homemade diets for a food trial, there are various challenges and considerations. Nutrition should be a factor when using home-prepared diets; achieving a balanced and complete combination of ingredients is complicated, and a nutritionist must be used, particularly in growing puppies or dogs with concurrent disease and unique nutritional requirements. Choosing the right ingredients can be complicated because of possible cross-reactivity from different animal proteins or extensive exposure to different allergens in previous diets. If a home-prepared diet is the only option, choosing a vegetarian home-prepared diet can be the right choice for some dogs. There is no one diet for all patients, and some will require more than one.(12,13,14,15)

The diet trial duration should last six to eight weeks. To reduce diet duration and improve owner compliance, using oral steroids to control inflammation or an antipruritic medication such as oclacitinib or ilunocitinib will improve skin condition and help control secondary infections using additional strategies such as topical therapy and systemic antimicrobial medication when this is warranted.

Accurate information from the owner regarding how well the diet is being followed is crucial during this phase. Understanding the level of itching in the patient is also important for effectively responding to the information and adjusting or altering the plan. (16)

Diet provocation

After the patient has been on a strict diet for the necessary time, and if skin lesions are under control, medications to prevent itching might be stopped so pruritus can be evaluated by the owner; this step of the process can be tricky because itch perception is not only subjective but also needs training from the veterinary team so the owner can

recognize the symptoms early and not wait until the patient is in crisis causing skin lesions, delaying the conclusion of the diet trial phase.

If medications are stopped and the patient is presenting no or minimal pruritus, a diet provocation can be pursued; some owners will be reluctant to change things for their dog when things are going well, but performing this step is crucial to complete a diet trial and collect the necessary information regarding food as a causing factor for the clinical symptoms. Diet provocation can be performed using a previous diet or individual proteins. Ideally, owners should observe their dog closely for at least the first 3 to 6 days to catch any changes in itch behavior and any other changes, including gastrointestinal problems. Many dogs will present symptoms in the first 24-48 hours, but some can take 14 days to develop a reaction.

The veterinary team should be instructed on how and when to make changes, and good communication is essential so the owner avoids mistakes that can delay the conclusion of this complicated process.

In the lecture, we will cover strategies to improve client compliance with diets and move forward in the diagnostic process. I have found that many owners will get stuck for lengthy periods with diagnostic diet trials, and some clients will be lost in the process. We must consider that extensive owner education and communication are needed to succeed and perform a dietary challenge to confirm the diagnosis. The clinician must also decide when the diet should be challenged, the diet trial extended, or a second or third dietary option used.

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WEDNESDAY, APRIL 30, 2025 | 11:30 AM

Fungal Diseases for Vet Techs

FLÁVIA CLARE, DVM, MSC, PHD

DERMATOPHYTOSIS IN DOGS AND CATS

Introduction
Dermatophytosis is a superficial fungal infection affecting the skin, hair, and nails of dogs and cats. The primary causative agents are *Microsporum canis*, *M gypseum* (*Nannizzia gypsea)*, and *Trichophyton mentagrophytes*. It is a zoonotic disease, meaning it can be transmitted to humans. Although often self-limiting, treatment is important to shorten the disease duration and reduce transmission risk (Moriello, 2019; Xia et al., 2018).

Prevalence and Risk Factors
Dermatophytosis is more common in young animals (puppies and kittens), free-roaming pets, and those in shelters or group housing. It is more prevalent in warm and humid climates. Certain breeds, such as Persian cats and Yorkshire Terrier or hunting dogs, are more predisposed. Interestingly, FIV or FeLV status in cats is not considered a significant risk factor (Moriello et al., 2017).

Diagnosis
No single test serves as the definitive diagnostic method. A multifaceted approach is recommended:

- Wood's Lamp Examination: Especially effective for detecting *M. canis* due to its fluorescence.
- Direct Microscopy: Identifies fungal elements in skin scales or hairs.
- Dermoscopy: Useful for identifying signs like comma hairs.
- Adhesive Tape Cytology: Particularly useful for detecting dermatophytes in dogs with kerions and in cats (Bouza-Rapti et al., 2023).
- Fungal Culture: Considered the gold standard, especially using the toothbrush method.
- PCR Testing: Highly sensitive, detects both viable and non-viable fungal DNA (Mendes et al., 2024).
- Biopsy: Reserved for atypical or nodular lesions.

Treatment
Treatment should always combine topical and systemic therapies. Topical antifungals include lime sulfur dips, miconazole with chlorhexidine shampoos, and enilconazole rinses. Chlorhexidine alone is ineffective.
Systemic antifungals:

- Preferred: Itraconazole and terbinafine for their safety and effectiveness.
- Alternative: Griseofulvin, though associated with more side effects.

- Less Recommended: Ketoconazole and fluconazole.
- Not Recommended: Lufenuron, due to lack of efficacy in controlled studies (Moriello, 2004).
- Vaccines: Not protective when used alone but may assist as adjuncts.

Environmental Control

Thorough environmental disinfection is crucial. Dermatophyte spores can persist for up to a year. Cleaning and disinfection of washable materials, clipping lesions, and regular topical treatment are essential. Strict confinement is not necessary and can negatively impact animal welfare (Frymus et al., 2013).

Zoonotic Considerations

While dermatophytosis can be transmitted to humans, especially children and immunocompromised individuals, infections are typically mild and treatable. Good hygiene and prompt veterinary care greatly reduce risks. T. rubrum, the most common human dermatophyte, is generally not acquired from animals (Patel, 2011).

Key Takeaways

- Use a combination of systemic and topical therapies.
- Employ multiple diagnostic methods.
- Ensure thorough environmental hygiene.
- Educate pet owners about zoonotic risks.
- Avoid ineffective treatments such as lufenuron.

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MALASSEZIA DERMATITIS IN DOGS AND CATS

Background & Purpose

Malassezia are lipophilic yeasts naturally present on the skin of warm-blooded animals. Although usually harmless, they can cause dermatitis and otitis in animals with compromised skin barriers (Bond et al., 2020).

Taxonomy & Biology

The genus Malassezia has expanded from 2 to 18 known species thanks to molecular studies. These yeasts depend on external lipids due to the absence of fatty acid synthase. *Malassezia pachydermatis* is the predominant species in dogs and cats, although others like *M. nana* and *M. slooffiae* are occasionally isolated in cats (Cabanes, 2014; Guillot & Bond, 2020).

Pathogenesis

Malassezia can transition from harmless commensals to pathogens in the presence of host-related factors such as allergies or immune dysfunction. Virulence factors include lipases, phospholipases, and biofilm formation, all contributing to inflammation in predisposed animals (Bond et al., 2020).

Diagnosis

Diagnosis includes evaluation of clinical signs (e.g., pruritus, erythema), cytological assessment of yeast numbers from skin or ears, and, in selected cases, culture or molecular techniques to identify species. Histopathology is useful for atypical cases (Guillot & Bond, 2020).

Clinical Presentation

In dogs, Malassezia commonly causes otitis externa and dermatitis. In cats, it is less frequent and often associated with systemic illnesses or certain breeds like the Devon Rex and Sphynx (Bond et al., 2020).

Treatment

Topical treatments include antifungal shampoos containing miconazole, chlorhexidine, or ketoconazole. Systemic antifungals such as itraconazole or ketoconazole are indicated for more severe cases. It is critical to identify and manage underlying conditions to prevent recurrence (Guillot & Bond, 2020).

Prevention

Preventive measures include maintaining skin barrier health, managing allergies, and monitoring predisposed breeds for early signs of infection (Bond et al., 2020).

Zoonotic Risk

Although Malassezia can be isolated from humans, zoonotic transmission is rare. Caution is advised particularly in immunocompromised individuals (Guillot & Bond, 2020).

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Feline Sporotrichosis Caused by *Sporothrix brasiliensis*

Introduction

Feline sporotrichosis is a zoonotic subcutaneous mycosis that has become a major public and veterinary health concern in South America, particularly Brazil. While historically attributed to *Sporothrix schenckii*, recent phylogenetic studies have identified *Sporothrix brasiliensis* as a distinct species with higher virulence and transmissibility, particularly in cats. This emerging pathogen is associated with severe cutaneous and mucosal infections, and its high fungal burden in feline lesions enhances zoonotic transmission potential (Gremião et al., 2020).

Epidemiology

The disease is hyperendemic in Brazil, with over 10,000 feline cases reported in Rio de Janeiro alone since the late 1990s. *S. brasiliensis* has also been identified in Argentina, Paraguay, and more recently in Colombia, indicating regional spread (Etchecopaz et al., 2019). Transmission between cats, and from cats to humans, primarily occurs via scratches, bites, or contact with exudates from ulcerated lesions. Unlike the classical environmental route of infection (e.g., via contaminated plant material), this zoonotic transmission route is a unique epidemiological hallmark of feline sporotrichosis (Rodrigues et al., 2020).

Pathogenesis and Clinical Features

Cats infected with *S. brasiliensis* often present with multiple ulcerative nodules, especially on the head, forelimbs, and tail base. Lesions may extend to mucosal tissues including the nose, conjunctiva, and oral cavity. A distinctive feature is the **high fungal load**, particularly in the nasal cavity, making cats potent sources of environmental contamination and zoonotic transmission (Boechat et al., 2018).

Systemic dissemination can lead to respiratory symptoms, lymphadenopathy, or general malaise. Despite the severity of lesions, many cats remain in relatively good general condition, though severe or disseminated cases are associated with higher mortality.

Differential Diagnosis

Feline sporotrichosis must be differentiated from other causes of ulcerative or nodular dermatitis such as:

- Cryptococcosis
- Mycobacteriosis
- Cutaneous leishmaniasis

- Squamous cell carcinoma
- Deep pyoderma

Accurate diagnosis is critical to avoid inappropriate treatment, delay in antifungal therapy, and continued zoonotic risk.

Diagnosis

The gold standard remains **fungal culture**, ideally from lesion exudate or biopsy samples. **Cytology** is widely used due to its rapid results and high sensitivity in feline cases. Yeasts appear as cigar-shaped structures in macrophages or extracellularly.

Molecular diagnostic tools, including PCR and gene sequencing, allow species-level identification and epidemiological tracking. ELISA-based serology is under evaluation but not yet standard. Histopathology may show pyogranulomatous inflammation and yeast forms in tissue.

Treatment and Management

First-line therapy consists of **itraconazole (100 mg/day orally)** for a minimum of 4 to 6 weeks beyond clinical resolution. In refractory cases, **potassium iodide** may be added. For severe systemic disease, **liposomal amphotericin B** is an alternative, especially in immunocompromised animals.

Treatment must be **prolonged (often 3–6 months)** and requires close follow-up. Premature discontinuation is the most common cause of recurrence. Environmental cleaning and isolating infected animals are crucial to minimize transmission.

Adverse effects of antifungals (e.g., hepatotoxicity from itraconazole) require regular monitoring of liver enzymes.

Public Health Impact

The zoonotic nature of feline sporotrichosis necessitates a **One Health** approach. Cats act as amplifiers of infection, and outbreaks among humans are directly linked to the feline epidemic.

Recommendations include:

- Immediate treatment and isolation of infected cats
- Public awareness campaigns
- Use of personal protective equipment (PPE) by veterinarians and caregivers
- Reporting of cases to public health authorities

Efforts to control the epidemic require collaboration among veterinarians, physicians, researchers, and policymakers.

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WEDNESDAY, APRIL 30, 2025 | 2:00 PM

The Impact of Climate Change on Allergic Disease in Veterinary Dermatology

TRICIA SOWERS, PHD

Course Objectives

We will explore the critical intersection of climate change and the growing incidence of allergic disease. We will consider how rising temperatures, elevated carbon dioxide levels, urbanization, and erratic weather patterns are contributing to longer pollen seasons, increased allergen loads, and enhanced allergen potency. We will the clinical implications for allergic patients and strategies to mitigate these effects through informed care and education. The key course objectives include:

1. Understanding the increasing prevalence of allergic diseases and the role climate change plays in driving this trend.
2. Examining the greenhouse effect, carbon fixation, and their impact on allergenic plant growth and pollen production.
3. Analyzing the specific allergenic characteristics and trends of key plant species, including birch, oak, grass, and ragweed.
4. Evaluating how urbanization and air quality influence the distribution and potency of allergens.
5. Considering diagnostic and therapeutic strategies tailored to evolving allergen profiles and extended pollen seasons.

Introduction

Climate change is a global phenomenon with far-reaching impacts on ecosystems, agriculture, and human and animal health. Among the most significant concerns in veterinary medicine is its effect on allergic diseases. Rising temperatures and increased atmospheric carbon dioxide levels have led to extended pollen seasons, higher pollen loads, and increased allergenic potency. Urbanization and pollution further exacerbate these effects and can amplify the allergic response in animals.

Climate Change and Pollen Dynamics

Extended Pollen Seasons and Increased Pollen Loads

Studies indicate that rising temperatures lead to longer growing seasons, with trees, grasses, and weeds pollinating earlier and persisting longer into the fall. For example, ragweed pollen seasons have lengthened by an average of 27 days since 1995 in northern latitudes, directly correlating with warmer temperatures and delayed first frost dates. Similarly, birch pollen seasons now start approximately six days earlier per decade, extending allergic exposure periods and increasing the prevalence of allergic reactions. Increased CO_2 levels also stimulate plant growth, enhancing pollen production and exacerbating allergic reactions in susceptible animals. This phenomenon has been observed across multiple allergenic species, including oak, timothy grass, and ragweed.

The Role of CO_2 in Allergenicity

CO_2 fertilization effects have led to increased pollen loads across multiple allergenic plant species, including ragweed, oak, and timothy grass. Elevated CO_2 levels have been shown to increase the major allergen concentrations within pollen, presumably making allergic responses more severe in animals. Studies on oak pollen have demonstrated a 1,200% increase in pollen production under high CO_2 conditions, intensifying allergenic exposure. Additionally, ragweed pollen grains grown in CO_2-enriched environments contain significantly higher concentrations of the major allergen Amb a 1, potentially leading to heightened immune responses in affected animals.

Plant Distribution

In addition to the impact of climate change on season initiation, duration, pollen load and antigenicity, shifts are occurring with respect to plant distribution. Heat sensitive species are migrating to more northern latitudes – this is best illustrated with Birch. Non-native, heat tolerant species are becoming more prevalent, as well. Ragweed prevalence has expanded considerably over the last two decades, with pollen now routinely being measured in Canadian provinces, where it was once completely absent. This shift in plant distribution can have an impact on allergic sensitization among geographical locations.

Urbanization and Air Pollution Effects

Urban Heat Islands and Pollen Potency

Urban environments further contribute to allergic disease through heat island effects, increased CO_2 concentrations, and air pollution. Studies indicate that allergenic plants in urban areas flower earlier and produce more potent pollen compared to their rural counterparts. In cities, ragweed plants grow larger and produce significantly more pollen per plant due to elevated CO_2 levels. Additionally, the combination of increased

temperature and prolonged growing seasons leads to greater sensitization rates among animals, making urban areas hotspots for allergic disease.

Air Pollution as an Allergen Adjuvant

Air pollution, particularly particulate matter (PM2.5 and PM10), nitrogen oxides, and ozone, interacts with pollen to increase allergenic potency. Pollutants can stress plants,

leading to greater expression of allergenic proteins, while also breaking pollen grains into smaller particles. This phenomenon is thought to exacerbate allergic dermatitis in veterinary patients.

Key Allergenic Plant Species in Veterinary Medicine

Ragweed (Ambrosia spp.)

Ragweed is a highly allergenic weed species that thrives in disturbed soils and arid environments. Its pollen is lightweight and travels long distances, significantly contributing to seasonal allergies in animals. Rising CO_2 levels have increased ragweed pollen loads and allergenicity, heightening clinical symptoms. Ragweed pollen can remain airborne for extended periods, making it a pesky allergen species, due to it's widespread distribution. Additionally, its invasive nature allows it to establish itself in new areas, further increasing allergenic exposure.

Timothy Grass (Phleum pratense)

Timothy grass is a major allergenic grass species prevalent in temperate climates. Its pollen is a significant contributor to summer allergies. Climate change has extended its pollen season, leading to increased sensitization rates in animals. Elevated CO_2 has been linked to enhanced pollen production and allergen concentration. Timothy grass pollen has a high degree of cross-reactivity with other grass species, making it a primary concern for allergic patients. Studies have shown that the major allergens in timothy grass pollen, such as Phl p 5, are more potent under increased CO_2 conditions, leading to stronger immune responses.

Oak Trees (Quercus spp.)

Oak trees are a dominant tree allergen that pollinates in early spring. Oak pollen is highly prevalent in urban and suburban areas, often forming dense airborne clouds. Increased CO_2 and urbanization have contributed to higher oak pollen loads and increased allergenicity, exacerbating allergic conditions in veterinary patients. Oak pollen grains contain multiple allergenic proteins that are resistant to environmental degradation, allowing them to persist in the air for extended periods. In animals, exposure to oak pollen has been linked to chronic atopic dermatitis.

Implications for Veterinary Dermatologists

Diagnosis and Management Strategies

Veterinary dermatologists will likely need to adjust their diagnostic and treatment approaches in response to climate-induced allergy changes. Monitoring regional pollen counts, updating diagnostic panels, and modifying immunotherapy formulations can improve patient outcomes. Increased pollen exposure requires careful consideration. Given the growing pollen loads and allergenicity, allergen-specific immunotherapy (ASIT) protocols may need to be adapted to account for increased exposure levels.

Additionally, veterinarians should consider multimodal approaches, including anti-inflammatory therapies and barrier protection strategies, to manage allergic conditions effectively.

Environmental Control and Preventive Measures

Client education on environmental control strategies is crucial in mitigating allergic symptoms in animals. Advising pet owners to avoid high-pollen environments, when possible, and encouraging consistent bathing of pets after outdoor exposure can reduce allergenic load and subsequent effects. Awareness of urbanization effects and air pollution levels should also inform treatment and avoidance strategies.

Conclusion

Climate change is fundamentally altering the landscape of allergic disease in veterinary medicine. Extended pollen seasons, increased pollen loads, and rising CO_2 concentrations are exacerbating allergic conditions in animals. Veterinary dermatologists must stay informed on these environmental changes to optimize diagnostic accuracy and treatment efficacy. By implementing proactive measures, veterinarians can better manage the evolving challenges posed by climate change and its impact on allergic disease.

WEDNESDAY, APRIL 30, 2025 | 3:00 PM

Engaging Veterinary Technicians in Veterinary Dermatology

JENNIE TAIT, AHT, RVT, VTS (DERMATOLOGY) CHARTER MEMBER

Introduction

As a seasoned veterinary technician with 39 years of experience, I have seen veterinary medicine evolve—especially the role of veterinary technicians.

I discovered my passion for dermatology 25 years ago when I began working in a dermatology referral practice at a veterinary teaching hospital. Since then, I have been recruiting dermatology enthusiasts and helping to shape how veterinary technicians contribute to dermatologic care.

Why Dermatology Matters

Dermatology is a **major component** of veterinary practice, yet it is often overlooked as a specialized area where technicians can shine.

- **Prevalence in Practice:** Studies suggest **approximately 20% of cases** seen in general practice have a dermatologic component. [1]
- **Top Insurance Claims: 4 out of the 5 most common insurance claims** for dogs are dermatology-related. [2]
- **Chronic Management:** Most dermatologic conditions require **lifelong care**, making client education and technician involvement critical.

The Challenge

With 90% of dermatology cases presenting with **pruritus**, and only **7 reaction patterns** [3] in the skin, many cases look nearly identical upon presentation. The challenge is to:

- Gather a thorough **history**
- Conduct and interpret **diagnostics**
- Differentiate between **parasites, allergies, immune-mediated conditions, and neoplasia**
- Guide **owners** through a long-term management plan

This is where **technicians play a crucial role** in client communication, diagnostics, and treatment support.

The Role of Veterinary Technicians in Dermatology

Technicians are **essential** in streamlining dermatology cases. Their contributions include:

1. History Taking & Preliminary Examination

- Gathering an **in-depth dermatologic history**
- Performing a **preliminary dermatologic exam**
- Identifying **skin lesions, infections, and inflammation**

2. Diagnostic Procedures

- Conducting **in-house cytology**, skin scrapings, and fungal cultures
- Processing and analyzing samples
- Presenting findings to the clinician, enabling efficient case management

3. Client Education & Compliance

- Explaining **diagnoses, treatment plans, and expectations**
- Demonstrating proper **medication administration** (topicals, oral meds, bathing routines)
- Supporting **antimicrobial stewardship** through proper medication use

4. Technician-Led Appointments

- **Routine rechecks** (cytology, bloodwork, treatment monitoring)
- **Follow-ups on chronic cases**, freeing up clinician time (Lokivetmab injections[4])
- Building **client trust and confidence** in technician expertise

The Economic Value of Engaging Technicians in Dermatology

In 2019, the **Ontario Association of Veterinary Technicians (OAVT)** conducted a study to quantify the value of RVTs in practice.[5] The findings were eye-opening:

- Clinics where **DVMs performed RVT duties had lower annual revenue per veterinarian**

- Clinics that **empowered RVTs** to perform their full scope of practice saw **higher revenues per veterinarian**
- Hiring **more RVTs per veterinarian** was linked to **higher annual gross revenue per vet**

👉 **Bottom Line:** Utilizing RVTs effectively leads to increased efficiency, better patient care, and improved clinic profitability.

Getting Technicians Interested in Dermatology

Encouraging technicians to develop an interest in dermatology is straightforward:

✅ **Encourage Curiosity & Growth** – Foster a culture of learning
✅ **Provide Hands-On Training** – Allow techs to actively participate in dermatology cases
✅ **Offer Continuing Education** – Support attendance at conferences, online courses, or VTS specialization
✅ **Create Dermatology Champions** – Identify and mentor passionate technicians within the clinic

Optimizing Workflow: The Dermatology Referral Model

Dermatology cases **require more than a standard 20-30 minute appointment**. Clinics can improve efficiency by:

Initial Consults (1 Hour Appointment)

1. **Technician Prep (15 min):** Review history, prepare paperwork
2. **Client Interaction (10-15 min):** History taking, derm exam, sample collection
3. **Diagnostics (5-10 min):** Cytology processing & analysis
4. **Case Presentation to Clinician (5-10 min):** Review findings, formulate plan
5. **Clinician Appointment (20 min):** Exam, finalizing treatment plan
6. **Discharge (10-15 min):** Technician reviews instructions, medications, next steps
7. **Post-Appointment (15 min):** Finalizing paperwork

⏳ **Total Technician Time: 1 hr 30 min**
⏳ **Total Clinician Time: 30 min**

Recheck Appointments (30 minute appointment)

1. **Technician Prep (15 min)**
2. **History & Exam (5-10 min)**
3. **Diagnostics & Case Review (5-10 min)**
4. **Clinician Update (10 min)**
5. **Discharge (5-10 min)**

⏳ **Total Technician Time: 1 hour**
⏳ **Total Clinician Time: 20 min**

The Impact of Teamwork on Efficiency & Work-Life Balance

In our referral practice, we have:
✔ **3 clinicians** working with **6 technicians**, ensuring efficient patient flow
✔ **2 additional technicians** dedicated to client communication follow-ups
✔ **A focus on technician empowerment**, allowing dermatologists to see more cases
✔ **A structured schedule** that gets everyone home by **5:30 PM**, improving work-life balance

Dermatology in General Practice: Setting Up for Success

- **Book extended appointments** for dermatology cases to allow thorough workups
- **Train front desk staff** to set realistic expectations for pet owners
- **Leverage external resources** like the **Canadian Academy of Veterinary Dermatology (CAVD)** and their **Empathy for Itch (EFI) Campaign**

✅ **Direct clients to the EFI Pet Parents page** for education and realistic expectations
✅ **Use the EFI dermatologic history questionnaire** to streamline case preparation

The Technician's Role in Preserving the Human-Animal Bond

Chronic dermatologic diseases **can strain the human-animal bond**. Veterinary technicians play a **pivotal role** in preserving it by:

- **Empowering owners** with knowledge and confidence
- **Providing ongoing support** throughout lifelong dermatologic care
- **Fostering strong technician-client relationship**

- **Final Thought: "Teamwork makes the dream work."** By fully integrating technicians into dermatology cases, we improve efficiency, patient care, and job satisfaction while ensuring the best possible outcomes for pets.

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WEDNESDAY, APRIL 30, 2025 | 4:30 PM

Radiology Basics for Veterinary Technicians

AGUSTINA ANSON DVM PHD DECVDI

Introduction

Radiology is a critical component of veterinary diagnostics to assess internal structures and detect abnormalities that may not be visible through physical examination alone. Veterinary technicians play an essential role in obtaining high-quality diagnostic images by ensuring proper patient positioning, selecting appropriate imaging techniques, and adhering to safety protocols. Various imaging modalities are used in veterinary medicine, each with specific applications suited to different clinical scenarios.

Imaging modalities

Radiography is the most widely used imaging modality in veterinary practice. It is particularly effective for evaluating bones, thoracic and abdominal structures, and some soft tissue abnormalities. Radiographs are essential in diagnosing musculoskeletal, cardiovascular, and abdominal conditions. Technicians must be skilled in patient positioning and exposure settings to produce clear, diagnostic images while minimizing radiation exposure.

Fluoroscopy is a dynamic imaging technique that provides real-time, moving X-ray images. It is commonly used for evaluating swallowing disorders, tracheal collapse, vascular studies, and contrast procedures such as gastrointestinal motility assessments.

Ultrasonography is a non-invasive imaging technique that provides real-time visualization of soft tissues. It is particularly useful for evaluating abdominal organs, the heart, and guiding procedures such as biopsies or fluid sampling.

Computed Tomography (CT) uses X-ray technology to create cross-sectional images, providing a detailed three-dimensional view of internal structures. CT scans are especially useful for evaluating skeletal disorders, nasal, ear, abdominal and cardiothoracic diseases, and neoplasia. They are commonly employed for surgical planning and oncology cases. Veterinary technicians may assist in patient preparation, including sedation or anesthesia, to ensure motion-free imaging.

Magnetic Resonance Imaging (MRI) is the gold standard for imaging neurological conditions, spinal disorders, and soft tissue abnormalities. Unlike CT, which relies on X-rays, MRI uses powerful magnetic fields and radiofrequency waves to to align and then disrupt hydrogen atoms (contain in water molecules) in the body. As these atoms return

to their normal state, they emit signals that are detected and converted into highly detailed images. MRI is always done under anesthesia as the procedure requires complete stillness for accurate imaging. Because MRI uses a powerful magnet, it's very important to make sure no metal objects are in or on the patient or staff. Items like jewelry, pacemakers, or metal implants can be dangerous—they may move, heat up, or interfere with the images. Patients and staff must be always screened carefully and follow strict safety protocols before entering the MRI room.

Each of these imaging modalities plays a unique role in veterinary diagnostics. By understanding their applications and principles, veterinary technicians contribute significantly to accurate diagnoses and effective treatment plans.

Radiation Safety

Radiation safety is a crucial aspect of veterinary radiology. While diagnostic imaging is indispensable, exposure to ionizing radiation—from radiography, CT, and fluoroscopy—can pose health risks to both patients and personnel if not properly managed. Veterinary technicians must adhere to the ALARA principle (As Low As Reasonably Achievable) by using appropriate protective equipment such as lead aprons, gloves, thyroid shields, and leaded glasses. Technicians should avoid manual restraint by utilizing positioning aids or sedation. Proper collimation, correct exposure settings, and routine equipment maintenance are essential to minimizing scatter radiation. Additionally, radiation dosimetry badges should be worn to monitor cumulative exposure, and all staff should be trained regularly in radiation safety protocols. By prioritizing these practices, veterinary technicians help maintain a safe working environment and uphold regulatory compliance, while ensuring the highest standards of patient care.

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15: A five-month temporal study of the skin microbiome of 15 healthy Dogs

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Abstract: A knowledge of the composition of the cutaneous core flora is important if we are properly to understand dysbiosis, which has been reported in allergic skin conditions, for example. In order to assess putative candidates of a core flora a temporal, or longitudinal study, is ideal. This temporal study sampled the skin on the axilla, umbilical region and groin of 15 healthy dogs (nine neutered males and six neutered females) with a mean age of 4.9 (range= 9 months – 12 years), monthly for five months. Separate samples were obtained and evaluated individually. Since there was no statistical difference between samples between sites, results were pooled into one collective sample per dog per time point, resulting in seventy-five total samples. The dogs were owned by members of the staff at a specialist-led small animal referral clinic at a local veterinary hospital. Flocked swabs were used to sample the skin. The microbiome was processed, sequenced, and analyzed via next-generation sequencing (NGS) (MiDOG Animal Diagnostics LLC; Tustin, CA). Bacterial and fungal DNA was amplified using the 16S rRNA V1-3 and ITS-2 genes, respectively. This was used to identify and quantify components of the bacterial microbiome. Environmental sampling was performed monthly. Acknowledging the none of these five were found on every dog on every occasion, we propose, based on the 70% prevalence in a temporal study, that coagulase-negative staphylococci, *Sphingomonas* spp., *Malassezia* spp., *Vishniacozyma victoriae* and *Cladosporium* spp. be considered as candidates for the core biome on the skin of healthy dogs.

Conflicts of interest: None Declared.

Sources of funding: MiDOG Animal Diagnostics LLC.

22: Comparison of whole blood ciclosporin concentrations in healthy dogs after a single oral administration of different modified ciclosporin liquids, a human generic and veterinary approved formulation

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Abstract: Oral modified ciclosporin liquid (Atopica, Elanco, Greenfield, IN, USA) is registered and used in cats to treat allergic dermatitis and in some countries for atopic dermatitis in dogs. Liquid formulations of ciclosporin may allow for more precise dosing across various patient weights versus capsules. Human generic modified ciclosporin liquid formulations are available at a lower cost than veterinary formulations; however, no investigations have been conducted regarding their use in dogs. The purpose of this randomized, blinded, cross-over study was to compare whole blood ciclosporin concentrations at 1 h and 2 h after a single 5 mg/kg oral dose of generic (treatment A; Teva Pharmaceuticals, Parsippany, NJ, USA) and Atopica (treatment B) modified ciclosporin liquid formulations. Eight healthy male-castrated fasted beagle dogs received treatment A or B with an eight-day washout period between treatments. Statistical analysis was performed using a two-way mixed effects model; significance was set at $p<0.05$. No significant difference was observed between groups at 1 ($p=0.43$) and 2 h time points ($p=0.23$). Within-group analysis revealed significantly higher ciclosporin concentrations for both treatments at both time-points compared to pre-treatment values ($p<0.01$ for all analyses). No significant difference was observed between 1 and 2 h post-treatment for either group (treatment A, $p=0.09$; treatment B, $p=0.56$). In conclusion, generic modified ciclosporin liquid formulation (Teva) achieved similar blood concentrations at 1 and 2 h post-administration as Atopica after a single oral administration in healthy dogs. Further clinical studies with generic modified ciclosporin are advocated to confirm therapeutic efficacy.

Source of funding: Self-funded.

Conflict of interest: None declared.

25: The use of fluorescent light energy in the treatment of skin diseases of Cats

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Abstract: Photobiomodulation is an effective treatment for animal skin diseases as a new therapeutic modality that utilizes fluorescent light energy (FLE). FLE promotes wound healing by stimulating cell proliferation, reducing inflammation and bacterial load. The authors report that four cats were treated with FLE (Phovia, Vetoquinol; Paris, France) at the Pet Care Animalia Clinic – Rio de Janeiro, Brazil. All cats received FLE applied on a two-millimeter layer of gel over the lesions for two minutes, once a week until total healing. The four cats, three males and one female, one Bengal cat and three Brazilian short haired cats had lesions diagnosed as feline idiopathic ulcerative dermatitis, parasiticidal spot-on drug reaction, sporotrichosis and eosinophilic plaque. Both cats with drug reaction and eosinophilic plaque had complete recovery in three weeks with only FLE treatment. The other cats received only six weeks of treatment and had clinical improvement, but they did not require continued treatment. The cat with sporotrichosis was treated with itraconazole 20 mg/kg per os, once a day (Cepav Lab, São Paulo, São Paulo, Brazil). Wound hygiene was carried out using saline solution twice a day in all the cats. FLE demonstrated that it can exert beneficial effects in cats with inflammatory skin diseases when used appropriately.

Source of funding: Vetoquinol funded this study.

Conflict of interest: None declared.

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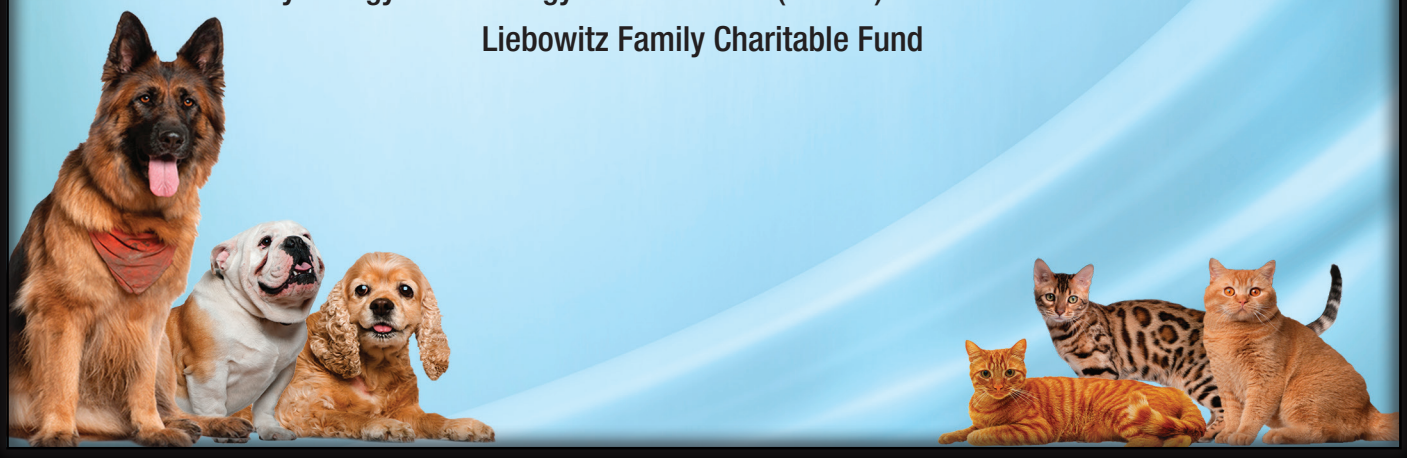

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