Small Animal Dermatology
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Conflicts of interest statement: In the last 5 years, I have received honoraria, consulting fees, and/or have collaborated with Royal Canin, Purina, Zoetis, and Novartis/Elanco. I am also the (volunteer) president of the Canadian Academy of Veterinary Dermatology.

About today’s lectures: My presentations will include some of the resources available on the website of the Canadian Academy of Veterinary Dermatology: www.cavd.ca. Some are open-access features while others are available to members only. Membership costs $25 for the remainder of 2019 and is open to all veterinarians and veterinary technicians in Canada.

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  - the Dog and Cat Itch Scale for scoring pruritus
  - the Cytology Scale for skin and ears
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  - updated lists of foods for dogs and for cats available in Canada for elimination diet trials
  - updated lists of topical therapies available in Canada and their indications
  - detailed article on Interpreting Small Animal Culture and Susceptibility Reports
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DERMATOLOGY DIAGNOSTICS BOOTCAMP

General Tips:
- using the condenser your microscope:
  - raise your condenser and open the iris (maximize light) for cytology
  - lower your condenser for skin scrapings (to increase contrast and make parasites more visible)
- coverslips
  - the high dry (400x) objective is intended for use with a coverslip! Images will be blurry without a coverslip, it does not mean the lens is dirty or has been dragged through immersion oil 😔
  - coverslips are very helpful for examining skin scrapings by making scraped materials into a tidy square and relatively thin preparation, rather than a widespread mess of peaks and valleys. They also help to ensure you examine all collected material in a skin scraping.
- taking photos of microscopy findings
  - unless you have a specialized image capture system, an easy way is to take photos using your smartphone stabilized by a cardboard roll placed over the eyepiece (without the roll, tiny movements of your hand make the image disappear). You have to cut the roll to the appropriate length which takes some time, so once you have it, hang on to it.

Cytology
A cytology scale can be very useful for quantifying the numbers of bacteria, inflammatory cells, and Malassezia on skin and ear cytology slides. You can find one at https://www.cavd.ca/resources/in-clinic-tools open access resources

Skin and ear cytology is a very high-yield procedure for patients with skin disease. It tells us more about what is going on with the skin or ears, more quickly, than any other laboratory diagnostic test. It is also inexpensive to perform. Nearly all patients with skin disease or ear disease, and particularly those with skin lesions or otic exudate, should have this test performed. It is also very useful for monitoring therapy, and should be repeated on follow-up visits as needed.

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Cytology from the skin can be collected in various ways. I use the **direct technique** or **tape wet mount** techniques. The technique used depends on whether the skin is dry, exudative, or greasy, on the site sampled, on the purpose of the sample collection, and on personal preference.

1. **Direct technique**

For the direct technique, material can be collected from the surface of the skin by one of the following methods:

1) impressions: directly pressing the slide on the skin several times. This may sometimes require opening a pustule, or removing a crust, if present.
2) swabs: swabbing the affected area, then rolling swab onto a slide. Commonly used in ears and folds.
3) scraping the surface debris from the skin and smearing the material onto a slide like buttering bread - scrapings are superficial (do not draw blood) and do not use oil. This technique can destroy cell architecture so I rarely use it.

Samples from dry or greasy skin are heat-fixed. This is not necessary when the collected material is moist and adheres well to the slide. Slides are stained with Diff Quick (fixative + 2 stains) and examined under high power with oil immersion.

In general, samples collected using the direct techniques have the following advantages and disadvantages:

**Advantages of direct technique:**

1) The direct techniques make a smear that is easier to read than the tape technique.
2) It is a thinner preparation so you don’t need to focus up and down as much. Nothing moves on a direct smear - it is stationary.
3) Organisms stain more deeply.
4) It is easier to identify and quantitate bacteria on direct techniques - rods vs. cocci can be differentiated more easily.
5) Inflammatory cells and other cells such as acantholytic cells can be identified more easily. The direct impression smears are best for identifying cells.
6) Makes nice preparations with moist, exudative lesions.

**Disadvantages of direct technique:**

1) Picks up much less material than a tape smear from non-exudative skin lesions.
2) May not obtain adequate samples from dry or minimally greasy skin.
3) Staining takes longer than with the tape preparations, as all 3 Diff Quick steps are used, and the slide must then dry.

2. **Tape wet mount technique**

For the tape technique, samples are collected as follows:

1) A 4 cm piece of tape is pressed onto the skin several times (usually 3), sticky side down. Clear tape is best.
2) The piece of tape is placed sticky side down on the clear part of the glass slide and attached to it by one end in order to hold it in place. Most of the tape is sitting on the glass slide but is not actually adhering to the slide.
3) A small amount of purple (last) stain of Diff Quick is introduced the space between the tape and the slide. One way to do this is to use an eyedropper or syringe to place a drop under the tape. A less "clean" technique is to immerse the slide in the stain for 1-2 seconds to allow the stain to enter the space between the tape and the slide. With the latter technique, the back of the slide is rinsed with water to remove excess stain.
4) The slide is blotted in a paper towel or bibulous paper to flatten the tape.
5) The tape is examined under high power using oil immersion.

In general, samples collected using the tape wet mount technique have the following advantages and disadvantages:

**Advantages of tape wet mount technique:**

1) Better at picking up a larger amount of material from minimally exudative or dry skin.
2) Much faster staining and no air-drying.
3) Well tolerated by pets in areas such as interdigital spaces.
4) Great for looking for *Malassezia*. This is the major advantage.

**Disadvantages of tape wet mount technique:**

1) The tape technique makes a very "busy" slide with lots of material. It can be a bit overwhelming when you first look at these types of preparations.
2) More difficult to examine for bacteria, which are often “swimming” in the slide.
3) Not good for identifying cellular inflammation, acantholytic cells, etc.

Why are there so many different techniques, and when do you use each one? Some of this depends on personal preference - many practitioners will always use one technique. However, each one is best for certain situations and
has advantages over the other techniques. Until you become very comfortable with cytology, I recommend trying the tape technique as well as one of the direct techniques on each patient.

Impression (Direct)
- Works well for: moist, exudative lesions, pustules (open with needle), crusts (peel crust, touch skin), very greasy skin, draining lesions
- Not good for: dry or minimally exudative lesions, small areas (e.g. nail folds), awkward areas (e.g. interdigital)

Swab (Direct)
- Works well for: moist, exudative lesions, small areas (e.g. face & lip folds, nail beds), ears
- Not good for: dry or minimally exudative lesions

Scraping (Direct)
- Works well for: large greasy lesions (if personal preference over tape technique)
- Not good for: sensitive areas, rambunctious patients, near eyes

Tape
- Works well for: greasy or dry skin, minimally abnormal skin, awkward areas, small areas, sensitive areas
- Not good for: purulent lesions, pustules, wet skin

Cytology examination and interpretation
Scan the slide at lower magnifications to find the areas containing the most material, then examine more closely under oil immersion. You will want to maximize the light when examining the slide under oil immersion (condenser raised), which is different from examining skin scrapings.

First, assess the presence and numbers of microorganisms. Examine at least 10 representative oil immersion fields. Remember that recent bathing interferes significantly with cytologic assessment.

Record the approximate numbers of yeast per field. These are most often Malassezia pachydermatis. For bacteria, it is easier to score them as 0 to 4+ rather than counting. Record whether they consist of rods, cocci, or a mixed population. You can use the semiquantitative scale below. Cocci are most often Staphylococcus pseudintermedius. Rod-shaped organisms are less common, and should be considered significant pathogens in most sites.

What numbers are significant? It’s difficult to establish a “cut-off”. In normal skin, although Malassezia and cocci are present in normal skin, we don’t find many using cytologic techniques. The numbers from moist areas such as the lip fold are higher than from truncal skin. Very low numbers of cocci and yeast may not be relevant. On the skin, I consider 1 or more Malassezia per oil immersion field significant but even lower numbers can be associated with disease. In the ear, 3 or more can be significant. Bacteria, when present, are usually found in higher numbers.

Finding them within inflammatory cells is considered to be significant in most cases.

Cytology is very useful for monitoring response to therapy for infections in the skin or ears. One can perform cytology at every visit in some pets because skin and ear infections can be dynamic and therapy can be adjusted accordingly.

It is also very important to examine cytology any time you collect a bacterial culture. The next step after assessing microorganisms is to assess the cellular response of the skin. This may include the presence of neutrophils, eosinophils, macrophages, acantholytic cells, or neoplastic cells. For inflammatory cells, the semiquantitative scale can also be used.

The key is to get familiar with cytologic techniques and to use them often; you will become more familiar with collection and interpretation very quickly.

One last note: Learn the difference between bacteria (which stain blue/purple) and melanin-laden melanosomes (similar in size, oval, but always brown/black and NOT blue/purple). Melanosomes are commonly found in pigmented skin.

Bacterial Cultures
Bacterial cultures are not routinely performed in uncomplicated bacterial pyoderma cases. Cultures are indicated in the following cases:
- <50% improvement after 2 weeks of antibiotics
- lesions remain after 4 weeks of antibiotics
- new lesions develop while on antibiotics
- deep/severe pyoderma
- phagocytosed rods on cytology
- suggestive history – previous treatment failures, frequent relapses, extensive antibiotic therapy
- possible zoonosis

Cultures of the skin are being submitted much more frequently in dermatology practice due to the emergence of methicillin-resistant staphylococci in companion animals.
Remember that all cultures should be accompanied by cytologic examination, and culture results should always be interpreted in relation to cytologic findings. For example, if cytology shows abundant coci but culture shows *E. coli*, it is likely that a contaminant not responsible for the skin disease has overgrown on the culture. I report my in-house cytology findings with the culture submission.

Discontinuing antibiotics for several days before culture is ideal to avoid interference with growth, but at least for superficial pyoderma, one study has shown no difference in the ability to culture *S. pseudintermedius* in dogs taking antibiotics and those not on treatment. (White SD el al, Evaluation of aerobic bacteriologic culture of epidermal collarette specimens in dogs with superficial pyoderma. J Am Vet Med Assoc. March 2005;226(6):904-8.) Cultures from the skin can be obtained in several ways. Ulcerated and erosive lesions are generally unsuitable. If intact pustules are present, they can be opened with a sterile needle and swabbed. The swab can be moistened with a bit of the transport medium to facilitate collection. Epidermal collarette lesions can be sampled by rolling a swab over the collarettes (I also gently undermine the edge with the culture swab) and this has been shown to be a simple and reliable method in superficial pyoderma in the study cited above. If only crusts are present, they can be lifted off the skin, and the underlying affected skin swabbed. Aseptic preparation should not be used for surface lesions. If plaques, nodules, deep pyoderma, or draining tracts are present, it is best to aseptically disinfect the surface and steriley collect samples by biopsy or aspiration. The biopsy can be sent to the laboratory in a sterile tube or transport medium (not formalin). If you suspect an unusual organism (*Nocardia, Actinomyces, Mycobacterium*), contact your laboratory for specific collection and submission guidelines. Not all organisms can be grown in a laboratory due to cultural requirements or safety concerns.

Your laboratory should always speciate staphylococci; the description “coagulase-negative staphylococcus (CoNS)” is not sufficient because the species is very important to assigning relevance to the cultured organism. For example, CoNS *S. schleiferi* is very significant, while other species of CoNS are uncommonly pathogenic, even if methicillin-resistant. Because some strains of methicillin-resistant staphylococci are extensively drug resistant and retain susceptibility only to amikacin, chloramphenicol, and rifampin, I feel that these three antibiotics should routinely be included in culture panels.

**Skin Biopsies**

Skin biopsies are indicated when dealing with a serious or poorly responsive skin disease. They should be pursued if neoplasia, immune mediated disease, or conditions only found on histology (e.g. zinc-responsive dermatosis, sebaceous adenitis) are suspected. Biopsies are also indicated if the skin lesions appear unusual, or to rule out uncommon differential diagnoses and narrow down your list. Biopsies are not a replacement for “derm due diligence”, most importantly skin scrapings and cytology.

If the lesions are secondarily infected, treatment with antibiotics for 1-2 weeks before biopsy is ideal. Select a variety of the most representative samples, including both primary and secondary lesions. Multiple samples (3 or more) should be submitted whenever possible, as well as a normal sample of nonlesional skin (unless collecting biopsies from the nasal planum or other sensitive areas). In general, ulcers and erosions should be avoided; the affected but still intact periphery of these lesions is more useful. Alopecic skin should be biopsied in the center of the most hairless areas as well as in the junctional and normal areas. For alopecic disorders, draw a line parallel to the direction of hair growth on the skin using a fine permanent marker, and center the biopsy over this line. Indicate that you have done so to the laboratory, and an effort will be made to trim the biopsy along this line. This allows the pathologist to examine the greatest number of entire hair follicles. Depigmenting lesions should be biopsied in an area of active depigmentation (gray color) rather than the final stage (white/pink). Pustules, papules, and vesicles are all very useful primary lesions. If taking biopsies of crusted areas, make sure to include the entire crust (it can sometimes fall off during collection but should be retrieved and placed in formalin). If the disease is heavily crusted, consider submitting one or two additional crusts with the notation “free crusts enclosed” on the biopsy form.

Skin biopsies from the trunk, most of the head, and the proximal limbs are easiest. For biopsies of the footpads, ears, and noses I recommend consulting Dr. Valerie Fadok’s excellent Medical FAQs on VIN entitled “Biopsying Places you don’t want to biopsy”.

Local anesthesia often suffices for biopsy collection. If biopsies involve the face, feet, ears, or other sensitive areas; if the patient is difficult to restrain, very small, or if a larger wedge biopsy is needed, sedation (in conjunction with local anesthesia) or general anesthesia can be used.

The sites to be biopsied generally should not be clipped of hair. If clipping is practically necessary due to extensive hair cover, they are clipped very gently using scissors or a clipper blade held several millimeters from the skin. The biopsy sites are marked. There should be no surgical preparation of the skin, with the exception of biopsies collected solely for deep bacterial or fungal cultures. If collecting for cultures, be sure to remove any disinfectant from the skin surface to prevent inadvertent killing of the organisms in transport. Skin biopsy is not a sterile procedure but infection of biopsy sites is very rare.

Approximately 0.5 to 1 ml of local anesthetic (usually 2% lidocaine, without epinephrine) is injected subcutaneously beneath the lesion in a fanning motion using a single 25 gauge needle stick. Be sure that the injection is deep enough not to disrupt the dermis. Lidocaine stings. Lidocaine injections can be rendered less painful by mixing a small amount of sodium bicarbonate (approximately 1 part to 10 parts lidocaine) into the syringe prior to injection. This
combination is not stable. Injecting slowly also seems to help. Allow 3-5 minutes for the skin to become numb. Keep in mind that for small pets, multiple lidocaine injections can exceed the toxic dose. Avoid exceeding 2.5 mg/kg in cats and 5 mg/kg in dogs. For example, a cat weighing 4 kg should get no more than 10 mg or 0.5 ml of 2% (20 mg/ml) lidocaine. In smaller pets, it is helpful to dilute the lidocaine 50% with saline to avoid causing toxicity. A 1% solution is still adequately effective.

Punch biopsies are most commonly used. A biopsy punch of appropriate size is rotated perpendicular to the skin, with moderate pressure, in one direction until a reduction in resistance is felt. A 6 mm punch is appropriate for most sites; a 4 mm punch may be preferred on eyelids, the nasal planum, and small footpads. The biopsy should not include a significant portion of normal skin in most cases. A small thumb forceps can be used to remove the biopsy "plug", which is usually attached by the subcutaneous tissue, and the attachment can be cut using iris scissors. The sample should be handled asatraumatically as possible, grasping should be done by the edge subcutaneous tissue rather than by crushing the entire plug. Elliptical biopsies are sometimes used to remove nodules, fragile lesions such as bullae, deep lesions involving the subcutaneous tissue, or when attempting to biopsy a continuum of lesions in one sample.

The biopsies should be placed in formalin immediately (except those for culture). During the colder months they must be protected from freezing en route to the lab. For example, skin biopsies can be fixed for 24 hr in formalin and then transferred them to isopropyl alcohol (minimum 70%) for shipping. Ask your laboratory for specific recommendations. Biopsy sites are then sutured: a cruciate pattern using 4-0 or 3-0 nylon suffices for most 6 mm biopsies. Pets generally do not bother their biopsy sites, but consider a physical barrier such as an e-collar when collecting biopsies from very pruritic animals or from the feet.

Send skin biopsies to a pathologist with a special interest in dermatology. Remember that a skin biopsy can sometimes "miss" a diagnosis that is made more easily another way. Examples include most ectoparasite infestations, dermatophytosis, and Malassezia dermatitis. Skin biopsies are not always helpful in animals suspected of being allergic, except to rule out similar-appearing "zebras". One of the most important factors determining the usefulness of a skin biopsy is the submission of a good history, examination findings, and differential diagnoses. Don’t skip this step. In addition to histopathology, biopsies can be used for immunohistochemical staining to look for various organisms or for antibody deposition in immune-mediated diseases.

Allergy Testing

Allergy testing – whether intradermal or serologic - is used to select offending allergens for avoidance or inclusion in allergen-specific immunotherapy. It is not used to diagnose atopic dermatitis but is usually performed when an owner has an interest in pursuing immunotherapy. It is not appropriate to perform allergy testing to answer the question is "is this patient environmentally allergic?" but rather to answer "which specific substances is this patient sensitive to?". Although food-specific IgE testing is offered by many laboratories performing serum allergy testing, these tests should not be used for the investigation of food allergy as the results can be highly misleading. There is no clear consensus regarding the superiority of intradermal vs. serologic allergy testing but many dermatologists favor the intradermal test as it investigates reactions in the directly affected organ. It is also common for dermatologists to combine the results of the two tests to select allergens for immunotherapy.

Intradermal Allergy testing

Intradermal allergy testing ("skin testing") is performed in pets diagnosed with environmental allergies (atopic dermatitis). This test is routinely performed by dermatologists and less frequently in general practice, partially because of the experience required to become proficient with the test. Small amounts of commonly offending allergens are injected intradermally and compared to a positive (histamine) and a negative control. The appearance of a wheal at the injection site, suggesting type-I hypersensitivity and thus the presence of IgE bound to mast cells in the skin, suggests that the injected allergen is of significance to the patient. The test is technically easier to interpret in dogs than in cats.

Serum testing for Allergen-specific IgE

Serum allergy tests use ELISA methodologies to quantitate circulating allergen-specific IgE levels. In general, serum allergy tests do not correlate closely with intradermal allergy tests and even other IgE serology tests. There has been no conclusive evidence for the superiority of one test over the other because no "gold standard" exists. However, it is known that when technical performance is used as a criterion, there are substantial variations between certain laboratories.
CANINE ATOPIC DERMATITIS


Articles in the CVJ Dermatology Column, a regular feature since 2018, are all archived at the CAVD website: https://www.cavd.ca/publications/canadian-veterinary-journal

Canine atopic dermatitis (AD) is defined as a genetically predisposed inflammatory and pruritic allergic skin disease with characteristic clinical features, associated most commonly with IgE antibodies to environmental allergens (1). Successful treatment of AD in dogs is multimodal and must be responsive to change. It consists of treating acute flares of the disease as well as managing the chronic condition (2). Client communication and education are crucial, as affected dogs can be successfully managed, yet rarely cured.

Veterinarians have, in recent years, been witness to major advances in the treatment of canine atopic dermatitis (AD). While the principles of therapy remain unchanged, the options for treating the inflammation and pruritus that characterize AD have greatly increased. The wealth of choices can feel like an "embarrassment of riches": an overabundance of good things, leading to more options than one knows what to do with. This update provides a summary of the current therapies and guidelines for using them to treat this very common disease.

Atopic Dermatitis: Multimodal therapy treatment guide

Multimodal therapy

If we are using antipruritic/antiinflammatory monotherapy, particularly in young dogs, we may be missing out on opportunities to prevent the progression of the disease, to treat it without affecting normal immune function, and sometimes even to cure the patient. While we are controlling some of the most important clinical signs, we are not altering the natural progression of the disease. Thus in every patient, we should consider the implementation of a multimodal treatment approach for best results. The components of the multimodal approach are to:

1. Reduce pruritus and inflammation
2. Treat and prevent secondary infections
3. Alter the immune response
4. Improve barrier function
5. Reduce allergen exposure

The four symptom-relieving interventions for AD with good evidence of high efficacy discussed in these notes are glucocorticoids (oral and topical), cyclosporine, oclacitinib, and lokivetmab. Due to their very different mechanisms of action, benefits, and side-effect profiles, all of them have a role in the treatment of AD. Although many other treatments including antihistamines, fatty acids, topical tacrolimus, interferons, misoprostol, pentoxifylline, vitamin E, vitamin D (3) and vitamin D (3) have shown some efficacy for AD, their use as monotherapy is uncommon. Innovative therapies such as vaccination against Interleukin (IL)-31 (4) or other novel treatments may increase our already impressive arsenal in the future.

1) Reduce pruritus and inflammation

Glucocorticoids

Oral glucocorticoids such as prednisone, prednisolone, and methylprednisolone have been a staple of therapy for AD for decades. They exert their myriad anti-inflammatory effects by repressing inflammatory genes such as those for cytokines, adhesion molecules, inflammatory enzymes, and receptors (1) and provide a potent broad-spectrum “hammer” to quickly and reliably reduce inflammation in atopic skin. Because most dogs with AD respond very well to oral glucocorticoids, a poor response should prompt us to consider alternative diagnoses or complications such as skin infections (2). The usefulness of systemic glucocorticoids for chronic AD is limited by long-term adverse effects with which we are very familiar (1). However, glucocorticoids remain an excellent choice for treating acute flares for periods of several days to weeks in healthy dogs. Although side-effects are common, they are often tolerable to clients if the treatment duration is short and if they have been adequately prepared. Dogs vary with regards to their sensitivity to glucocorticoid side-effects. A commonly recommended starting dose of prednisone for dogs is 0.5-1 mg/kg per day for several days, followed by a taper (1). I often start with lower doses (<0.5 mg/kg per day) in large dogs with good results and fewer adverse effects. Glucocorticoids can be safely combined with lokivetmab, but long-term combination therapy with cyclosporine or oclacitinib is usually avoided.
With the new treatments available for the treatment of AD, why reach for oral glucocorticoids? They are still the most effective agents for reducing severe inflammation quickly, or for treating skin and ears with severe secondary changes such as lichenification and ceruminous gland hyperplasia.

Topical glucocorticoids can be very useful for the management of localized signs of AD such as pododermatitis and otitis externa with a lower risk of systemic adverse effects. They can also combine well with other therapies. Otic topical glucocorticoids such hydrocortisone in ProOtic HC™ (Pro Concepts Animal Health, Toronto, Ontario) or in compounded formulations (e.g. Burow’s solution) can be used for the maintenance and prevention of ear infections in dogs with allergic otitis externa. Hydrocortisone aceponate (Cortavance® Topical Spray Solution, Virbac Canada, Cambridge, Ontario) is a potent dermal glucocorticoid spray with a low rate of percutaneous absorption. Used as labeled (for 4 consecutive days), it can treat acute localized flares of AD. Several studies confirm the efficacy and safety of this product for longer periods. A study comparing Cortavance® and oral cyclosporine used up to 84 days (daily, or less often if possible) showed no differences in the scores for efficacy, tolerance, or ease of administration (5). Another study showed that proactive twice weekly treatment (“weekend therapy”) was well tolerated and effective in extending the period between relapses of clinical signs from a mean of 33 days to 115 days (6). It has also been shown to be effective in cats. Patients treated for longer than the recommended period should be carefully monitored for cutaneous atrophy (7), which in my experience is more common when topical glucocorticoids are applied to inguinal and axillary skin.

Cyclosporine
Cyclosporine (Atopica®, Elanco Canada, Guelph, Ontario), available in Canada for more than a decade, is labeled for the control of clinical signs of AD in dogs 6 months of age and older. It revolutionized our ability to treat atopic dogs by giving us the first effective symptom-relieving drug that freed many dogs of their steroid reliance. Cyclosporine has proven to be a very useful and safe (8) alternative to long-term glucocorticoid therapy. Cyclosporine exerts its effects primarily through lymphocytes, giving it broad-spectrum anti-inflammatory activities. The remission of clinical signs is markedly slower than with the other therapies but its overall efficacy in reducing pruritus and skin lesions is similar to that of oclacitinib after several weeks have elapsed (9). Co-administering lokivetmab can be helpful for rapidly reducing pruritus. Alternatively, oclacitinib (10) or oral glucocorticoids can be added for the first 1-3 weeks. However, the long-term co-administration of these drugs is not recommended.

Has cyclosporine become obsolete with the arrival of newer therapies AD? Absolutely not. Due to its broad-spectrum effect on inflammation, it remains a valuable part of our treatment arsenal.

Additional information on extralabel drug use: Cyclosporine has been used to treat a very large number of inflammatory skin conditions including Perianal fistulæ, Granulomatous sebaceous adenitis, Idiopathic facial dermatitis of the Persian cat, Erythema multiforme, Sterile granuloma / pyogranuloma syndrome, Sterile nodular panniculitis, Pemphigus foliaceus, pemphigus erythematosus, Idiopathic German shepherd deep pyoderma, Proliferative otitis, Feline eosinophilic granuloma complex, Ulcerative dermatosis of the philtrum, Metatarsal fistulas of German Shepherds, Sterile nodular panniculitis, Reactive histiocytosis, Uveodermatologic syndrome (VKH-like syndrome), Feline plasma cell pododermatitis, Cutaneous lupus erythematosus. Essentially, many diseases are steroid-responsive are also cyclosporine-responsive.

Oclacitinib
The line-up of treatments of AD increased in 2016 with the arrival of a very effective and much-anticipated addition, oclacitinib (Apooquel™, Zoetis Canada, Kirkland, Quebec). Apoquel™ is approved in Canada for the control of pruritus associated with allergic dermatitis and the control of AD in dogs at least 12 months of age. This Janus Kinase 1 inhibitor inhibits the activity of various pre-inflammatory and pruritogenic cytokines at their receptors. Among these is IL-31, one of the critical cytokines mediating pruritus in dogs. The primary biological function of IL-31 in mammals appears to be the induction of itch (11). However, IL-31 also has pro-inflammatory and barrier-disrupting roles in other species in which it has been studied, which may further contribute to its importance in AD (11).

Oclacitinib has provided veterinarians with a novel, effective and well-tolerated treatment for AD (9) (10) (13). A key benefit of the drug is its impressively rapid efficacy (9), which is comparable to that of oral glucocorticoids. In contrast to glucocorticoids, oclacitinib is well tolerated by most dogs, even when used for long periods.

Dosing
- aim for 0.4-0.6 mg/kg once daily long term
- for dogs 20.0 - 26.9 kg, can combine half tablets to reduce cost of therapy (as per Zoetis US website)
- avoid long term BID use, including splitting the daily dose into two half doses
  - one unpublished study (abstract by Denti D et al, Vet Dermatol 2018; 29, 360) showed statistically significant reduction of neutrophils, eosinophils, and monocytes at mean dose 0.5 mg/kg BID

Additional information on extralabel use:
- cats
  - not very effective at canine doses (5/12 cats responded in one study)
  - much shorter half life
- Oclacitinib at 0.7-1.2 mg/kg BID for 28 days vs. methylprednisolone 0.5-1.0 mg/kg BID. (Noli et al. Vet Derm 2019; 30:110.)
- not statistically different but methylprednisolone performed better
- 4/14 oclacitinib cats tested had mild increase in renal values
- “Oclacitinib was well tolerated by cats at 1 mg/kg and 2 mg/kg BID for 28 days and appeared to be a safe medication for this species” (Lopes NL. BMC Veterinary Research 2019; 15:137)

- **other conditions**
  - 1 case of good response with subepidermal blistering disease in a dog
    - severe and very refractory to therapy with GC and cyclosporine
    - rapid response allowing steroid discontinuation

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**Canine Atopic Dermatitis Immunotherapeutic**

Since June 2017, lokivetmab, or canine atopic dermatitis immunotherapeutic (Cytopoint®, Zoetis Canada, Kirkland, Quebec) has been available in Canada as an aid in the reduction of clinical signs associated with AD in dogs. This therapy is unique in that it is a caninized monoclonal antibody that targets and inhibits the activity of IL-31. Its spectrum of activity is narrower than that of oclacitinib since it does not impact other cytokines. Cytopoint® is administered by subcutaneous injection every 4-8 weeks (mean interval between injections was 37 days in one study). It has been shown to be a safe (14) and effective (15) (16) treatment for canine AD. One should not consider lokivetmab as an “injectable Apoquel”: despite its activity on the same key cytokine, the two treatments are very different. Perhaps surprisingly, lokivetmab can work well even in dogs responding poorly to oclacitinib (17). Moreover, it can be safely combined with oclacitinib – or any other treatments for AD - when additional anti-pruritic activity is needed. My observation is that this extremely useful therapy is often overlooked, perhaps due to its arrival on the heels of oclacitinib.

- **Consider Cytopoint®:**
  - concurrent disease such as systemic infection, neoplasia, demodicosis
  - patients < 1 year of age
  - poor client or patient compliance
  - very small dogs
  - poor efficacy of other treatments, e.g. Apoquel™ not lasting 24 hr
  - side-effects from other treatments
  - as combination therapy
  - client preference

- **Field study with 135 dogs** (Souza CP et al, Vet Dermatol 2018, 29: 489)
  - overall 88% of dogs had reduced pruritus
  - ≥50% reduction in pruritus in 77% of dogs
  - can work well even when Apoquel™ has not
  - In 21 dogs with a partial or no response to twice daily Apoquel™, 15 (71%) responded to Cytopoint®
  - but dogs not responding to Apoquel are less likely to respond to Cytopoint®
  - note: some Cytopoint® non-responders can do well with Apoquel™

- **Additional information on extralabel use:** North American label dose: minimum 2.0 mg/kg q 4-8 weeks differs from European label dose: minimum 1.0 mg/kg monthly (European study with 274 dogs: Moyaert H et al. Vet Derm 2017; 28: 593.

- **NOT for use in cats**
# Principal symptom-relieving therapies in canine atopic dermatitis

<table>
<thead>
<tr>
<th>Apoquel&lt;sup&gt;™&lt;/sup&gt;: Oclacitinib</th>
<th>Cytopoint&lt;sup&gt;®&lt;/sup&gt;: Canine atopic dermatitis immunotherapeutic/Lokivetmab</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Uses</strong></td>
<td>• predominantly anti-pruritic, for short- or long-term use</td>
</tr>
<tr>
<td>• anti-pruritic and anti-inflammatory, for short- or long-term use</td>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>• effective anti-pruritic activity</td>
</tr>
<tr>
<td>• very rapid onset</td>
<td>• very rapid onset</td>
</tr>
<tr>
<td>• usually well tolerated</td>
<td>• well tolerated</td>
</tr>
<tr>
<td>• pharmacologic drug interactions unlikely</td>
<td>• can be combined with other treatments for AD including oclacitinib</td>
</tr>
<tr>
<td>• minimum age 12 months</td>
<td>• no minimum age</td>
</tr>
<tr>
<td>• may be less effective when severe inflammation, lichenification, otitis, pododermatitis are present</td>
<td>• no contraindications for concurrent illness including neoplasia, infections, and demodicosis</td>
</tr>
<tr>
<td>• increased pruritus can be seen when reducing (from twice daily) to once-daily therapy</td>
<td>• convenient</td>
</tr>
<tr>
<td>• include neoplasia, serious infections Monitoring</td>
<td>• laboratory monitoring not routinely needed</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>• high cost for large dogs</td>
</tr>
<tr>
<td>• clinical examinations, periodic CBC, serum biochemistry, urinalysis</td>
<td>• may be less effective when used alone if severe inflammation, lichenification, otitis, pododermatitis are present</td>
</tr>
<tr>
<td><strong>Common errors</strong></td>
<td>• prescribing it only for “desperate” cases</td>
</tr>
<tr>
<td>• attempting to reduce the dose to alternate-day therapy (unlikely to be effective due to short half-life)</td>
<td><strong>Contraindications</strong></td>
</tr>
<tr>
<td>• relying on oclacitinib exclusively for AD, at the exclusion of other therapies or adjunctive treatments (e.g. for concurrent infections)</td>
<td>• none, unless adverse effects have been noted</td>
</tr>
<tr>
<td><strong>Atopica&lt;sup&gt;®&lt;/sup&gt;: Cyclosporine</strong></td>
<td><strong>Monitoring</strong></td>
</tr>
<tr>
<td><strong>Uses</strong></td>
<td>• clinical examinations</td>
</tr>
<tr>
<td>• maintenance anti-inflammatory therapy; use when glucocorticoids would otherwise be chosen</td>
<td><strong>Common errors</strong></td>
</tr>
<tr>
<td>• chronic otitis externa, particularly with hyperplasia</td>
<td>• prescribing it only for “desperate” cases</td>
</tr>
<tr>
<td>• severe inflammation, e.g., pododermatitis</td>
<td><strong>Oral glucocorticoids: e.g. prednisone</strong></td>
</tr>
<tr>
<td>• severe secondary changes, e.g., lichenification</td>
<td><strong>Uses</strong></td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>• broad-spectrum anti-inflammatory</td>
</tr>
<tr>
<td>• usually well tolerated long-term</td>
<td>• short term use for allergic flares</td>
</tr>
<tr>
<td>• normalizes skin to help reduce secondary infections</td>
<td>• otitis externa, particularly with hyperplasia or ulceration</td>
</tr>
<tr>
<td>• labeled from 6 months of age</td>
<td>• severe inflammation, e.g., pododermatitis</td>
</tr>
<tr>
<td>• dose reductions often possible</td>
<td>• severe secondary changes, e.g., lichenification</td>
</tr>
<tr>
<td>• slow onset, not useful for flares</td>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td>• gastrointestinal side effects more common than with other treatments, but usually self-limiting</td>
<td>• potent anti-inflammatory and antipruritic effects</td>
</tr>
<tr>
<td>• high cost for large dogs at daily dosing</td>
<td>• consistently effective</td>
</tr>
<tr>
<td>• many drug interactions</td>
<td>• rapid onset</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>• low cost</td>
</tr>
<tr>
<td>• include neoplasia, serious infections Monitoring</td>
<td><strong>Disadvantages</strong></td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td>• many well-recognized adverse effects</td>
</tr>
<tr>
<td>• clinical examinations including oral examinations (gingival hyperplasia), periodic urinalysis (possibly urine cultures), CBC, serum biochemistry</td>
<td><strong>Contraindications</strong></td>
</tr>
<tr>
<td><strong>Common errors</strong></td>
<td>• many, including diabetes mellitus, severe infections, demodicosis</td>
</tr>
<tr>
<td>• routinely reducing the dose in all patients after 1 month, even if only partial improvement has been noted (daily dosing can be continued as needed)</td>
<td><strong>Monitoring</strong></td>
</tr>
<tr>
<td></td>
<td>• clinical examinations, periodic urinalysis (possibly urine cultures), CBC, serum biochemistry</td>
</tr>
</tbody>
</table>
2. “It’s complicated” – treat and prevent secondary infections
I’m always happy to see an atopic dog who is “just itchy”, but that patient is less common among my referrals. Most suffer from secondary skin and/or ear infections that can significantly increase their pruritus. Diagnosing and managing these secondary infections is key to successfully managing their skin disease. This is why dermatologists are enamored with cutaneous cytology, and why you should be too. Cutaneous cytology is a powerful but low-cost tool that yields results quickly. Cytology examinations are a great way to utilize the skills of RVTs. Regular collection increases the proficiency and confidence of the entire team. Cytology collection techniques are subject to personal preference. I prefer to use direct cytology preparations (touch preps, swabs) for samples that are moist and tape preparations for areas that are greasy, scaly or hard to reach. For example, direct preparations work well for ears, pustules, under crusts, erosions, epidermal collarettes, draining tracts. Tape preparations work well for lichenified skin, dry scaly skin, seborrhea oleosa, minimally lesional skin, or greasy interdigital skin. Some people use exclusively one or the other, and that is ok too.

Armed with cytology results, you can make a more appropriate treatment decision. The treatment of secondary infections is a huge topic in its own right and beyond the scope of this lecture. However, I can provide the following generalizations:

Otis externa that becomes recurrent despite otherwise adequate control of the atopic dermatitis and ear cleaning can benefit from the use of topical corticosteroids. For example, a low potency ear drop can be used a few times per week. A 1% hydrocortisone ear drop is now commercially available in Canada (ProOtic HC). Burrow’s 1% hydrocortisone solution (e.g. from Chiron Pharmacy) can also be used.

Malassezia dermatitis is, in my practice, a top reason for treatment “failures” of antipruritic drugs. This can be due to Malassezia hypersensitivity occurring in a subset of atopic dogs. Malassezia extract is included in my intradermal test panel for this reason. Malassezia hypersensitivity leading to severe pruritus can occur with even low numbers of Malassezia found on cytology, while in other dogs, modest pruritus accompanies a high yeast burden. It is thus inappropriate to provide an absolute “cut-off” for the number of Malassezia on cytology that should be treated. Most dermatologists err on the side of treatment with both topical and systemic therapies when pruritus is severe. The response to systemic treatment is an effective way to confirm the contribution of Malassezia to the overall pruritus in a particular patient. Cytology should always be used to confirm resolution of the infection. Although Malassezia is usually very responsive to therapy, keeping it away can be difficult.

Recommendations for the treatment of pyoderma have changed dramatically in recent years in response to the now fairly common finding of resistant staphylococcal pyoderma in dogs. In the past, systemic antibiotic therapy was a cornerstone of treatment of superficial pyoderma, with topical therapy considered adjunctive. Today, published evidence and practice experience strongly support the use of topical treatments as monotherapy whenever this is practical. Topical therapy has been shown to be equally effective in methicillin-resistant staphylococci as those that are methicillin-susceptible. Encouragingly, the use of a 4% chlorhexidine shampoo (twice weekly) and solution (daily) has been shown to be as effective as oral antibiotics for superficial pyoderma. We have also seen an impressive increase in the number of topical therapies available in Canada in recent years, with the appearance of 3 and 4% chlorhexidine shampoos, sprays, and wipes being particularly welcome. Another change is that when we consider systemic therapy, we are collecting bacterial cultures from the skin more often to look for resistant staphylococci. Skin infections are the #1 reason for antibiotic treatment in dogs. Let’s be mindful of our antibiotic use, and change this. In most cases we don’t need a systemic treatment for a superficial problem.

The CAVD maintains an updated list of the topical therapies (shampoos, wipes, and sprays) available in Canada. It is available to members in the Resources -> In Clinic Tools section of www.cavd.ca.

Patients requiring multiple courses of antibiotic for skin disease are primed for the acquisition of resistant staphylococci (“antibiotic roulette”) and referral to a board certified veterinary dermatologist should be recommended.

3. Alter the immune response
While we have many tools to help the pruritus, inflammation, and infections associated with atopic dermatitis, there is only tool that is considered a disease-modifying intervention: allergen-specific immunotherapy. Immunotherapy, the administration of gradually increasing amounts of allergens selected on the basis of intradermal and/or serologic allergy testing by subcutaneous injection or oral mucosal administration, is the only therapy thought to have the potential to reduce overall disease severity, prevent disease progression, or in some cases even cure the disease. Atopic dermatitis tends to progress over time, with increasing severity of signs. The duration of signs also tends to increase, with most chronically affected patients progressing to year-round disease. Anything we can do to reduce the likelihood of this progression is worth offering to clients and implementing early in the course of the dog’s life. Immunotherapy is, however, a slow acting therapy that is expected to help about 2/3 of atopic dogs. If requires follow-up, “troubleshooting”, patience and commitment on the part of the client and veterinarians. Referral to veterinary dermatologists, who have extensive experience with allergy testing, allergen selection, and prescribing immunotherapy, should be considered for dogs whose owners are interested in pursuing this treatment.

4. Improve the barrier function
This is the subject of intense interest in human and veterinary dermatology. The entry of environmental allergens into the body is through the skin rather than by inhalation (the term “inhalant allergy” is not correct). Ample evidence in human medicine and some evidence in veterinary medicine support that the normally robust barrier function of the stratum corneum is impaired in atopic individuals. This might be a primary (e.g. genetic) defect in some, and an acquired defect any time skin inflammation and infection is present. Controlling inflammation and infection is thus helpful to maintaining a healthy barrier. But there is more that we can do. Nutritional support of the skin – trying to improve the barrier from the inside – is one. The inclusion of essential fatty acids in the diets of atopic dogs may improve the barrier as well as reducing inflammation, although the ideal combinations and quantities are not established. Another ingredients, such as the “skin barrier blend” of amino acids and vitamins included in certain Royal Canin® diets have been shown to reduce transepidermal water losses (a measure of skin barrier permeability) when added to the diet of healthy dogs in a laboratory setting, and to reduce the owner-reported incidence of atopic dermatitis in Labrador dogs supplemented from puppyhood. Topical therapy – trying to improve the barrier function from the outside – is another approach. A number of products containing essential fatty acids, other lipids, ceramides, and other ingredients are marketed in Canada.

## 5. Reduce allergen exposure

Improving the barrier function helps with reducing allergen exposure. And for patients with Malassezia or staphylococcal hypersensitivity, so does controlling these infections. Bathing to maintain good skin hygiene (using cool or lukewarm water) at least once weekly can also help to reduce the build-up of allergens on the skin. More specific recommendations can be made if allergy testing is done. Even if not, house dust mites (e.g. Dermatophagoides farinae) are the most common environmental allergens for dogs worldwide. House dust mites are microscopic creatures feeding on human and animal dander, skin scales and hair. They do not live on animals or people, but are found in beds, pet beds, mattresses, carpets, sofas and pet bedding. Although it is virtually impossible to totally eliminate house dust mites from our environment, we can take steps to reduce their populations:

- Ask clients to keep their dogs out of their (human) beds, and bedrooms if possible.
- Ask clients to use pet beds that are completely washable. Do not use stuffed beds if the stuffing cannot be washed as it will accumulate dust mites. Use folded synthetic blankets or towels instead. Alternatively, if a stuffed pet bed is used, encase the stuffing in a sturdy trash bag and wash the cover weekly.
- Pet beds should be washed frequently at least weekly in HOT (55°C/130°F) water.
- The dog’s access to area rugs, carpets, stuffed toys, and upholstered furniture should be limited if possible.

Although implementing multimodal therapy is essential in atopic dogs, I feel that the discussion of this topic can easily overwhelm our clients. I try to use a drawn representation and currently the CAVD is working on an in-clinic tool to help with this. I prioritize what is important for each patient and usually don’t implement all of these steps simultaneously. For example, I might perform allergy testing at an initial visit but if I am making extensive changes in the pet’s therapies, I might wait to start immunotherapy until a subsequent visit once the other treatments are relatively stable. The same goes for dietary changes. I expect, and explain to clients, that establishing an acceptable maintenance protocol for each dog will require repeated visits. I provide a tracking calendar and a pruritus scale for owners (from the In-clinic Tools section of the CAVD website, www.cadv.ca) to monitor improvement in relation to treatments. The embarrassment of riches can lead to therapeutic dilemmas when I treat itchy dogs, but has also made their treatment more successful and rewarding than ever before.

### Bibliography


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Addendum: Client communications

Client communications:
- essential for the effective delivery of veterinary care
- dermatology = often complex diagnostic + therapeutic recommendations
- effective communication = facilitates connection between client and veterinarian

History Collection
- start with “open-ended inquiry”
- try not to interrupt
- move on to closed ended questions as needed

Reflective listening
- nonverbal communication as client is speaking
- paraphrase:
  - “So I understand that Barley...”
  - “… Did I miss or misinterpret anything?”
- allows client to make corrections if needed
- creates a sense of relationship-based communication

Making a clear recommendation
- how well do your clients adhere to our recommendations? estimates vary but veterinarians seem to overestimate adherence
- clients who receive a clear recommendation 7x more likely to follow it
- Some of my tips...
  - use visual aids such as pictures, diagrams, and charts
  - “chalk and talk” – use a pen and paper to help explain conditions and treatments
  - lay out expectations – e.g. no sure, but effective management possible
  - take care in presenting information on “methicillin-resistant Staph” as it can cause owners extreme worry.
    - Don’t call methicillin-resistant S. pseudintermedius “MRSA”. I prefer to tell owners that the culture shows a dog Staph bacterium called Staph pseudintermedius which is resistant to a number of antibiotics.
    - use a balanced handout such as the one from Worms and Germs Blog (can access at https://www.cavd.ca/resources/in-clinic-tools open access resources)
    - I discuss the risk of zoonotic transmission but emphasize that the risk is low
  - provide written instructions
    - specific treatments, when to recheck, general instructions (templates), and additional handouts as needed
  - use an itch scale and calendar pages for tracking treatments and progress (https://www.cavd.ca/resources/in-clinic-tools open access resources)
  - schedule recheck/follow-up and explain why
  - don’t try do to this in 15 minutes! recognize the value of dermatology patients in your practice – they are long term patients
  - listen and learn from your clients 😊

Additional Resources:
Royal Canin has developed a series of excellent E-learning modules called “Conquering Dermatology Conversations” which pertain to client communications. They are short, mobile-friendly, and suitable to all members of the veterinary team. Access them at http://www.royalcanin.ca/ and log in under “For Veterinarians”.

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21st CENTURY PYODERMA

This lecture presents the approach to patients with pyoderma and how it has changed in the last two decades since the emergence of methicillin-resistant *Staphylococcus pseudintermedius*. I will also describe the skin microbiome, which is an increasing area of interest in human and veterinary medicine.

Microbiome: The composition of all microbial genes in a community.
- your cells carry 20-25,000 genes
- your microbes carry 500 times more

Microbiota: An aggregate of microorganisms in a community, including bacteria, archaea, protists, fungi and viruses.
- you have ± 30 trillion human cells and ± 39 trillion microbial cells
- most are not pathogenic
- microbiota are essential to life

Past: culture methods (1-9% of totality)
Current: sequencing methods

Skin microbiome
- in humans, skin microbial communities tend to:
  - vary between body regions
  - be very diverse
  - be shared easily
- altered in disease states in humans and dogs
  - has been demonstrated in atopic dermatitis: flares are associated with loss of microbial diversity

Staphylococci
- part of normal cutaneous microbiota of mammals
- several species can be commensals and opportunistic pathogens
- pyoderma typically caused by the same strain found at carriage sites
- in dogs:
  - *S. pseudintermedius*
  - *S. schleiferi* (coag. variable)
  - *S. aureus*
- other coagulase-negative Staph (CoNS) can be highly resistant but usually not clinically relevant
  - important for your lab to ID the CoNS to species in case it is *S. schleiferi*

Methicillin-resistant (MR) staphylococci
- inherent resistance to all beta lactams
- commonly resistant to other antibiotics (MDR = multidrug resistant)
- MRSP has a concerning predilection to rapidly acquire further resistance
- skin infections are very common, so MRSP frequently isolated from dogs
- potential for zoonotic transmission

Spread of staphylococcal resistance
- MR and MDR staphylococci are very common in both carriers and animals with infections
- MRSP can be considered endemic rather than an emerging issue
- dominant strains can proliferate and outcompete other strains
  - e.g. antibiotic drug obliterates colonizing strains and allows recolonization by a resistant strain
  - this is likely mechanism by which MRS spread across animal populations
  - antibiotic therapy a risk factor

Dermatology and antibiotic use
- Skin problems are the #1 cause of antibiotic use in dogs
- 23-30% of all antimicrobials prescribed

But…
- MRSP is not more pathogenic than MSSP (just harder to treat systemically)
- pyoderma presents a key opportunity for antimicrobial stewardship
- good evidence that systemic antibiotics are not needed in most cases
- pyoderma is a SECONDARY condition

Pyoderma: general approach
1) confirm diagnosis
   - cytology

2) +/- culture:
   - <50% improvement after 2 weeks
   - lesions after 4 weeks
   - new lesions
   - deep/severe pyoderma
   - phagocytosed rods
   - suggestive history
   - possible zoonosis

3) implement topical therapy
   - topical therapy with chlorhexidine products appears to be equally effective to systemic antibiotics, even when infection is caused by MRSP
   - can consider dilute bleach soaks for patients not responding to chlorhexidine (e.g. 1:30 dilution of household bleach in water with 1/2 tsp baking soda per litre. Make fresh daily. Usually applied after shampooing and allowed to sit on the skin for 10 minutes before rinsing and conditioning. Irritating to some dogs and can discolor fur and fabrics). Hopefully bleach based shampoos will come to Canada.
   - accelerated hydrogen peroxide products such as Pure Oxygen Ultra – usefulness?
   - a CAVD-sponsored study is currently ongoing investigating the use of medical grade honey for fold pyoderma
   - tips for shampooing
     - volume of shampoo to use: 1 quarter sized amount per 2 palms surface area
     - 10 minutes contact time ideal for medicated shampoos
     - 2 times weekly to start + daily chlorhexidine spray
     - massage, starting with problem areas
     - use cool/lukewarm water
     - avoid standing water
     - make it a positive experience for the dog

4) +/- systemic antibiotics
   - Before reaching for these always consider: Do you need a deep treatment for a superficial problem?
   - Indications
     - deep/severe pyoderma
     - poor response to topical therapy
     - unable to use topical therapy (e.g. bathing cats)
   - base on culture whenever possible
   - always combine with topical therapy
   - most commonly use beta-lactam drugs if isolates are not MR
   - avoid empirical fluoroquinolones
   - if MR, select antibiotic carefully based on culture
     - clindamycin - check erythromycin
     - potentiated sulfas
     - doxycycline or minocycline – evaluate culture results separately
     - veterinary fluoroquinolone
   - What works today might not work the next time!
     - The "scary trio" – if extensive resistance leaving only chloramphenicol, amikacin, and rifampin as choices
       - Think again – do you really need systemic therapy given the potential for severe side-effects? ALWAYS combine with topical therapy. Warn owners.
       - Chloramphenicol: TID therapy, GI s/e, hind limb weakness, concern for human contact
       - Amikacin: SC q24hr (stings), renal tubular necrosis, check UA for casts and protein twice weekly
       - Rifampin: good tissue penetration but resistance develops quickly, hepatotoxicity, check chemistries q 7 days
   - Duration of therapy
     - usually 3 weeks for superficial pyoderma or 1 week past resolution of lesions
     - longer for deep pyoderma
     - but not based on any evidence!
“the idea that stopping antibiotic treatment early encourages antibiotic resistance is not supported by evidence, while taking antibiotics for longer than necessary increases the risk of resistance” Llewelyn M et al. BMJ 2017;358

- studies are needed for pyoderma
- consider shorter therapy if using a drug such as amikacin or rifampin

5) consider primary cause
   - In 30 dogs with recurrent pyoderma (Bensignor E, Germain PA. Vet Derm 2004; 15(s1):42)
     - 18 (60%) atopic dermatitis, 2 (7%) food allergy, 2 (7%) flea allergy, 2 (7%) hypothyroidism, 1 each hyperestrogenism, demodicosis, zinc-responsive, 2 (7%) no cause identified
   - Work-up and treatment depend on: signalment, age of onset, degree of pruritus especially when infection resolved (avoid or discontinue antipruritic therapy to assess pruritus when infection resolves), other clinical signs
   - Allergic dermatitis is most common primary cause:
     - elimination diet trial
     - treatment for allergy (Atopica®, corticosteroids, Apoquel®, Cytopoint®)
     - allergy testing and immunotherapy
     - allergen avoidance
     - skin barrier-enhancement
   - Other treatments
     - Staphage lysate® vaccine especially for idiopathic recurrent pyoderma
     - Undergoing investigation: S. pseudintermedius vaccine
     - future directions: interferons, antimicrobial peptides, bacteriophages, etc.?

6) client communications
   - more on this later
   - see https://www.cavd.ca/resources/in-clinic-tools for links to client handouts on MRSP and MRSA from the Worms and Germs Blog (which are balanced and practical, rather than panic-inducing)

7) schedule recheck
   - 2-4 weeks appropriate in most cases (2 if using systemic antimicrobials)

Major changes in my approach to pyoderma in the last 20 years
- I wear gloves to examine dermatology patients, wash my hands a lot, and wear a labcoat again (which I change if suspect resistant pyoderma)
- I'm a lot more concerned about resistance
- I'm more mindful of when and how I prescribe systemic antibiotics
- I rely a lot more on topical therapy alone
- I'm more patient
- I consider inter-animal transmission more than before, and the (low) potential for zoonotic transmission
- exam room cleaning includes floors between dermatology patients

The good news/silver lining to the emergence of MRSP: Pyoderma presents one of the key opportunities for antimicrobial stewardship in small animal practice!

Additional Resources for pyoderma/MRS: found at: https://www.cavd.ca/resources/in-clinic-tools:
- WAVD Clinical Consensus Guidelines for Methicillin-Resistant Staphylococci – a very thorough open access article about MRS
- lists of medicated veterinary shampoos, sprays, and wipes (member access) – a regularly updated Canadian resource
- Interpreting Small Animal Culture and Susceptibility Reports (member access) – a clinical pharmacologist's guide to interpretation
- Precautions when Handling Animals with Antimicrobial Resistant Infections (member access) - a nice reminder of what we can do to improved patient and staff safety with AMRs
- The Winter 2019 issue of the CAVD Bulletin entirely focused on Pyoderma and Methicillin-Resistant Staphylococci (https://www.cavd.ca/publications/the-bulletin, member access)

Thank you for attending!
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