Current Therapy for Dermatophytosis in Dogs and Cats

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Dermatophytes are a grouping of three keratinophilic fungal genera that commonly cause skin disease in animals and humans. These anamorphic (asexual or imperfect) fungi belong to the genera, Microsporum, Trichophyton, and Epidermophyton. Dermatophytes cause infection by invading and feeding off keratinized material. Dermatophytosis or 'Ringworm' is the skin disease caused by dermatophytes. Dermatophytosis is a common skin disease caused by infection of the hair follicle and hair with keratinophilic fungi. Dermatophytosis is more common in cats then in dogs. Wide variation in incidence exists globally; warm temperatures and high humidity encourage infection.

Classification is based on preferred habitat or protein source. Geophilic (Soil loving) - M. gypseum most common species, usually elicits severe inflammation. Anthropophilic (Human loving) - Cause most ring worm and athletes foot in humans, rarely cause disease in animals, when present – highly inflammatory. Zoophilic (Animal loving) – Cause most dermatophytosis in animals. Microsporum canis, Microsporum gypseum, and Trichophyton mentagrophytes are the 3 most common species of dermatophytes that cause skin infection in cats and dogs. All dermatophytes have the potential to be zoonotic. Feline dermatophytosis (M canis) is the most common zoonotic skin disease.

Pathogenesis

Dermatophytes invade actively growing hair, follicular keratin, claws ('nails'), and less frequently, the stratum corneum of the epidermis. Host response to metabolic byproducts of the dermatophyte causes inflammatory skin disease. Well-adapted dermatophyte induces minimal host response in their host species. In the cat, asymptomatic carriers are common, especially in Persian cats and other long-haired breeds. Asymptomatic carriers also can be seen in the dog, but are less common. Transmission occurs via direct contact or by fomites contaminated with hair or scale from affected cats or other dogs.

Microsporum canis is the most common dermatophyte seen in cats and dogs. The species designation 'canis' is a misnomer, since the cat is the natural host for this organism. In many parts of the world, up to 98% of feline ringworm is caused by M. canis. Infection with T. mentagrophytes, M. gypseum, or other dermatophytes which are poorly adapted to the dog elicits a greater inflammatory reaction. This can lead to self-cure in some dogs. T. mentagrophytes, M. gypseum, and various other keratinophilic fungi may, on occasion, cause feline dermatophytosis.

Risk factors

Cats with compromised immune function, such as seen with diabetes, naturally occurring or iatrogenic hyperglucocorticoidism, feline leukemia virus (FeLV) infection, or feline immunodeficiency virus (FIV) infection, are at greater risk for acquiring dermatophytosis. They also are at greater risk for developing more serious, prolonged, or generalized disease. Long-haired breeds such as Persians may be at increased risk for both asymptomatic and symptomatic dermatophytosis. Clinically obvious dermatophytosis is seen most commonly in kittens and in adult cats in association with stresses such as queening.

Similarly, dogs with compromised immune systems are at greater risk for chronic and generalized disease. Dermatophytosis usually is self-limiting in healthy dogs because the normal host inflammatory response eliminates infection. Breed or sex predilections have not been determined statistically. Some breeds of dogs (Dalmatian, Poodle, Jack Russell Terrier, and Yorkshire Terrier) appear to be at increased risk for generalized disease. Dogs less than a year of age are at greater risk for dermatophytosis. Older dogs with decreased immune function also may be at increased risk for generalized dermatophytosis.

Clinical signs: Feline

The clinical features of feline dermatophytosis vary considerably, but perhaps less than in dogs. Pruritus is variable but not common with feline dermatophytosis. More classical lesions appear as ring-like with expanding circular patches of alopecia with central healing and peripheral small papules. Irregular, patchy alopecia frequently is the only obvious abnormality. Affected hairs are irregularly broken leading to shorter, poor hair coats. Remaining hair stubble may be thickened. Follicular papules are the most common primary lesion. Follicular pustules, when present, are quite transient. Subtle alopecia with minimal other lesions is seen frequently in long-haired cats. Scaling and crusting can vary from absent to severe. "Miliary dermatitis" like lesions can also be seen. Asymptomatic carriers of M. canis is most common in long-haired breeds and in cats from large catteries, particularly in the Persian breed. The most common distribution is the face, pinnae, and forelegs but generalized patterns can also be seen. Rarer presentations would include dermatophytic pseudomycetoma, deeper nodular reactions, and claw infection (onychomycosis).

Clinical signs: Canine

Dermatophytosis is extremely variable in the canine. Scaling, crusting, and hair loss are the most common features. Pruritus or pain is uncommon, but may be seen with more severe inflammation. The most typical presentation is an expanding circular patch of alopecia

with an erythematous active border and an area of central clearing and healing. Infected hairs at the margin or within the alopecic patch are thickened and broken. Follicular papules or pustules may be seen. Scaling and crusting vary from minimal to severe. The face and forelegs are common sites for initial infection. These areas are environmental interfaces. Facial symmetry (periorbital, dorsal muzzle, pinnae may occur with T. mentagrophytes and less commonly with M. gypseum. The planum nasale is rarely affected despite active infection in adjacent haired skin. Claw infection (onychomycosis) usually is manifested by chronic infection of the ungual fold.

M. canis can be well adapted in the dog and therefore minimal lesions and inflammation can be seen. This is particular true in the feline, where minimal inflammation can be seen and in some cases aymptomatic carriers exist. Usually, T. mentagrophytes and M. gypseum are markedly less well adapted to canine skin and more dramatic inflammation can be seen. Dramatic well-demarcated inflammation and hyperpigmentation may be features. Kerion lesions are uncommon and characterized by intense focal inflammation and follicular destruction. Enhanced host immune response may be responsible. Kerion develop acutely as erythematous, exudative, alopecic, domed nodules. Most kerion are solitary, but multifocal lesions may be seen. Most kerion develop on the face or forelegs. The Boxer may be at increased risk for solitary lesions and the Golden Retriever may be at increased risk for multifocal lesions. Superficial pustular dermatophytosis is an uncommon, facially-oriented canine skin disease. It is caused by keratin-colonizing dermatophytes that attack the surface stratum corneum or superficial follicular keratin preferentially over hair. The zoophilic dermatophyte T. mentagrophytes including several subgroups is isolated most commonly. These dermatophytes may be less well adapted to canine and feline hosts and thus induce a more inflammatory cell-mediated response. Clinical features include pustules that eventuate in inflammatory erythematous papules and plaques with adherent crusts. Lichenification, alopecia, and hyperpigmentation occur with chronicity. The face is the most common site of involvement. Unlike other facial dermatophyte infections, the planum nasale may be affected. Terriers such as the Jack Russell Terrier, Fox Terrier and Manchester Terrier may be at increased risk.

Differential diagnosis

Cats - Hair loss without other obvious skin changes must be differentiated from pruritic self-traumatic alopecia, psychogenic alopecia, and demodicosis. Feline dermatophytosis also may present as miliary dermatitis must be differentiated from feline allergic miliary dermatitis. Severely exfoliative, crusting, or pustular dermatophytosis may resemble pemphigus foliaceus or superficial bacterial folliculitis.

Dogs - Canine dermatophytosis is greatly overdiagnosed; conversely, real cases often are misdiagnosed. Staphylococcal folliculitis and superficial spreading pyoderma are the major differential diagnoses since they may present with rings of alopecia and crusting. Severe facial dermatophytosis may mimic facially-oriented autoimmune skin disease such as pemphigus foliaceus or pemphigus erythematosus.

Diagnosis

Clinical suspicion of dermatophytosis is often based on history and physical examination. The most commonly performed diagnostic procedures include Wood's lamp analysis, cytology, fungal culture, trichogram and biopsy. Without question, fungal culture is the most effective diagnostic procedure.

Wood's lamp examination

A Wood's lamp is a specialized ultraviolet lamp with a cobalt or nickel filter that generates UV light at 253.7 nm. It is used in the diagnosis of dermatophytosis to locate affected fluorescing hairs. The procedure is relatively simple to perform, but interpretation is fraught with difficulty. Certain dermatophytes (primarily Microsporum canis and Microsporum audouinii and occasionally M. distortum and Trichophyton schoenleinii) produce a byproduct (a tryptophan metabolite) that fluoresces a blue-green color when exposed to a specific wave length of light. 30- 40% of Microsporum canis will give positive fluorescence. Since a high percentage of feline dermatophytosis is due to M. canis infection, the Wood's lamp is a more useful tool in feline dermatology. Ideally, the Wood's lamp should be turned on and allowed to warm up for 5 to 10 minutes since wave length stability and intensity are temperature dependent. Positive fluorescence is indicated by blue-green fluorescence coating affected hairs. The underlying skin and scales should not be affected. The skin as well as hairs fluoresce with false positive fluorescence. Scaling or crusting may give a yellowish color that is frequently misdiagnosed as positive fluorescence.

Fungal (dermatophyte) culture

Fungal culture is the most accurate and definitive method of diagnosing dermatophytosis in all species. Hair and scale specimens are placed on appropriate media for fungal culture. Fungal culture confirms the presence of a dermatophyte and also identifies the species of dermatophyte which is important in determining the source of infection. The area to be cultured should be gently blotted with alcohol and allow to dry, then broken hairs and fine scales are collected with a hemostat and pressed onto agar, incubated and checked daily. The Mackenzie toothbrush technique utilizes brushing a sterile toothbrush through cat's hair coat and placing it on culture media. Dermatophyte test media (DTM) is the best media for fungal culture. The media contains a phenol red pH indicator. Before use, DTM is amber yellow. Dermatophytes preferentially utilize protein in the media first and produce alkaline metabolites that turn the media red. (Most saprophytic fungi and bacteria preferentially utilize the carbohydrate first and produce acid metabolites that do

not cause a media color change in the media. However, saprophytes switch to protein metabolism after using up the carbohydrates, eventually turning the media red. The red color change caused by a dermatophyte should occur early, just at the time when the fungal colony first becomes visible. Dermatophytes produce fluffy light-colored colonies. Saprophytes often produced green or black colonies.

Trichogram
Trichogram examination for ringworm organisms requires training and practice. Affected hair is plucked with a hemostat. A drop of mineral oil or clearing agents such as 20% solution of KOH or chlorphenolac is placed on the hairs and covered with a cover slip. Hairs are examined with a microscope with a high contrast, condenser moved to a lower position. This should then be examined under 4 or 10 power objectives. Affected hairs have a 'rotting log' appearance or seem to be surrounded by small 'pearls'.

Cytology
Simple impression smear cytology stained with Diff Quik stain can reveal fungal hyphae and/or spores. These will often appear with a capsule or halo surrounding the spores or hyphae. These are best found when samples are taken from more inflammatory lesions and usually require identification under oil immersion.

Biopsies
Although considered the most optimal way of identifying dermatophytes these can be found with the aid of special stains that highlight fungal spores and/or hyphae. PAS or silver stains are the most common stains used to stain specifically for fungal organisms. Other changes commonly used on biopsies are areas of folliculitis, furunucolosis with variable areas of nodular inflammation. Some fungal infections will also occasionally produce surface or follicular acantholysis.

Treatment
Although common, dermatophytosis is occasionally difficult to treat. It is especially difficult to eliminate dermatophytosis in a multi-cat household. Fortunately, many animals with dermatophytosis self-cure over 2 to 3 months. Ideally, systemic and topical therapy should always be used together. Systemic therapy usually is necessary to achieve cure and topical therapy is useful in diminishing inflammation and preventing spread.

Systemic therapy
Systemic therapy is most likely to both induce resolution of skin lesions. Treatment is continued until a fungal culture is negative for 2 months. Azole systemic antifungals are the most successful drugs to use and include ketoconazole, itraconazole and fluconazole . Synthetic imidazoles inhibit sterol synthesis via fungal cell cytochrome P-450, also inhibit fatty acid and triglyceride synthesis, inhibit nucleic acid synthesis, and affect the biochemistry of numerous oxidative enzymes. Hepatic metabolism by cytochrome P-450 enzymes can lead to unexpected toxicity or lack of efficacy when coadministered, with other drugs that are metabolized by P-450 enzymes. Dosages used in dermatology have a much better history of safety than dosages used for systemic mycoses. Hepatotoxicity concerns are over emphasized. Ketoconazole commonly causes gastrointestinal upset in cats and is associated with a higher incidence of hepatotoxicity in cats. Azoles can be very expensive, but vary markedly from country to country. Ketoconazole and fluconazole are available as generics in the U.S. Ketoconazole and fluconazole are the drugs of choice currently in dogs. Fluconazole or itraconazole are the drugs that can be used in cats. The dosage of all 3 drugs for dermatophytes is 10 mg/kg once daily given orally. Itraconazole is now considered the drug of choice for treating feline dermatophytosis as adverse reactions are uncommon and in experimental models it is equal or superior to griseofulvin. However, the expense of itraconazole can be prohibitive. There are now a number of protocols that utilize the medication in pulse or cycle fashion. Griseofulvin is an oral medication produced by Penicillium griseofulvum, mode of action is controversial, drug is deposited in the epidermis and epithelial adnexa, microsized & ultramicrosized formulations improved absorption, mildly bactericidal. It is not commonly used with the advent of azoles and their effectiveness and reduced incidence of side effects. Griseofulvin adverse drug reactions are seen more commonly in Persians, Himalayans or Siamese cats. It must be given orally with a fatty meal. Cats should be FeLV/FIV negative since leucopenia may be induced. To be effective, griseofulvin must be given at least daily and in a sufficient dose to obtain fungistatic levels in the skin. Severe side effect: idiopathic bone marrow irreversible suppression, and teratogenicity. Microsize dosage - cats: 50 mg/kg/day divided; dogs: 50-100 mg/kg/day divided. Ultramicrosize dosage - cats: 5-15 mg/kg/day divided; dog: 10-30 mg/kg/day divided. Terbinafine is a synthetic antifungal allylamine derivative, developed for nail infections in humans, high tissue concentrations are reached. The drug is beneficial for dermatophytosis including claw bed fungal disease. Unfortunately, the brand name human drug is expensive. A new generic is now available making it more affordable. It has been used in cats at dosages of 30 to 40 mg/kg per day. Terbinafine is well tolerated. It may be possible to administer this medication in a pulse or cycle therapy fashion.

Topical therapy

Topical therapy has long been advocated for the treatment of dermatophytosis. However numerous studies have shown that topical therapies alone are not as effective as systemic therapy. The most important benefit from topical therapy is to kill infective spores on the cat or dog and limit spread of this material into the environment. There have been several studies evaluating the efficacy of various topical therapies and lime sulfur and enilconazole are the two most effective antifungal topical therapies and should be applied twice weekly. Chlorhexidene alone and povidone iodine are ineffective against infective spores and hairs and are no longer recommended for use. Topical therapy should be used, whenever permissible, in conjunction with systemic therapy. Clipping the entire hair coat has been advocated in treating dermatophytosis. Clipping will remove infective material and make topical therapy easier. However, the clipped hair if not handled appropriately can worsen environmental contamination. Animals can have lesions spread and worsen, if clipped too closely. The usefulness of clipping may depend on individual situations; long-haired animals should be clipped and all cats in an affected Persian cattery should be clipped.

Environmental treatment

Environmental decontamination is very important in preventing spread of infection to other animals or re-infection. However, environmental decontamination is extremely difficult, if not impossible, to accomplish in some environments. It should be assumed that environmental contamination with M. canis spores is widespread and that uninfected cats may transport spores on their hair coats. The best agents for disinfection continue to be debated. Studies have evaluated the efficacy of many antifungal disinfectants. When contaminated surfaces were cultured after a single application of a disinfectant only undiluted bleach (100% elimination), a 1:10 dilution of bleach (22% elimination) and enilconazole (33% elimination) had efficacy with a onetime surface application. An environment with infected cats within it will need to be treated repetitively as the cats will continue to shed infective hair and spores. Furnace filters, fabric pet beds, and blankets should be replaced or discarded. The environment can also be problematic to disinfect if there is lots of fabric or carpet used to cover surfaces. Carpets and furniture can be steam cleaned and this will decrease but not eliminate all spores.

References & Recommended Readings

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