Fungal Skin Infections
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Dermatophytes
Dermatophytes are fungal organisms that invade, live in, and affect keratinized structures, i.e., the horny layer of the epidermis, hair, and claws. Under normal circumstances, they do not invade, nor can they survive in living tissue. In cats and dogs, most cases are caused by Microsporum canis (some cases have shown this to be a ‘natural’ part of the skin flora of healthy cats, although this finding has been disputed, and may relate to where the ‘healthy’ cats were found – in private homes or in pet shelters, for example). Less common species implicated in dermatophytosis in cats are Microsporum gypseum and Trichophyton mentagrophytes – these species are more common in dogs.

Transmission is usually animal to animal but may be soil to animal in the case of M. gypseum. Human to animal is quite rare, but animal to human (M. canis infection from cats to children) certainly may occur. A number of factors influence the susceptibility of the animal to a dermatophyte infection: age (young are more susceptible), nutritional status, concurrent disease (ie retrovirus infections), immunosuppressive drugs, etc.

The invasion of the hair shaft with fungal elements weakens it and facilitates breakage. The fungi elaborate substances that can act either as ‘toxins’ (primary irritants) or even as allergens Clinical features may include alopecia, crusting, erythema, pruritus, papular eruption (‘miliary dermatitis’) and claw damage. Occasionally, deep infections resulting in draining tracts and/or nodules (pseudomyxomentomas) may be seen. Dogs that like to dig in the ground and/or roam outside sometimes present with dramatic crusts and erythema on the face, the ears, with progression to the legs and even the foot pads. Often, there is intense pruritus as well. These dogs have an infection with either T mentagrophytes or M gypseum. Do NOT be dissuaded by a lack of contagion in other animals or the owners, or even by a negative dermatophyte culture - T mentagrophytes especially can be difficult to culture. A biopsy, with special stains for fungi, may show the organism quicker than a culture; histology may occasionally show acantholytic cells. A clue is that while the face, especially the muzzle may be affected, the nasal planum (due to the lack of hair follicles) is usually spared.

Diagnosis of dermatophytosis is made by history, clinical signs, and the following:

Wood’s light - must be allowed to warm up for at least 3-5 minutes. Hand-held Wood’s lamps are not effective. M. canis is the primary dermatophyte affecting cats that will produce fluorescence. Fluorescence is caused by tryptophan metabolites. As it is the infected hairs that fluoresce, sample these hairs for culture (fluorescence will not occur in the cultured colonies). The fluorescence is bright yellow-green; comparable to the face of watch. Not all M. canis infections will exhibit fluorescence, perhaps only 30-50 % will, so DO NOT rule out dermatophytes based on a negative Wood’s lamp test!

Direct microscopic examination – difficult to do. Scales and hairs are collected by plucking or scraping the suspected lesions. The material is placed on a glass slide, a drop or two of 10 - 20% KOH or chlorphenolac added (or even mineral oil), a cover slip applied (the KOH preparation would be gently heated), and then examined microscopically. Spores should surround, and hyphae be within, hair shafts.

Fungal cultures - The most definitive method of diagnosis. The area to be cultured should be gently cleansed with water (although the author rarely does this). Material is gathered in the same method as for direct examination. Fine scales and broken hairs should be obtained: large crusts or tufts of hair should be avoided. Using a toothbrush to obtain samples from a carrier cat may also be used. Material may be sent to an outside lab or an in-house method may be used. Dermatophyte Test Media (DTM) is the usual media utilized. The principle behind the media is the presence of phenol red, a pH indicator. Before use, DTM is amber in color. Dermatophytes utilize the protein in the media and produce alkaline metabolites that turn the media red; most saprophytic fungi and bacteria utilize the carbohydrate in the media and produce acidic metabolites which cause no color change. After using up the carbohydrates, the saprophytes will switch to protein metabolism and also turn the media red.

For proper use and interpretation of DTM, several precautions need to be taken.

The hairs and scales should be pressed into the agar but not buried.
The cover should be loose to allow for adequate aeration.
Incubation should be done at room temperature.
The media should be examined daily.
With a dermatophyte, the red color should occur at the time the colony is first visible.
After prolonged growth, most saprophytes will eventually turn the media red.
Dermatophytes should be fluffy, light colored colonies.
Any colony that has a green or black coloration should be regarded as a contaminant.
A wet mount or ‘scotch’ tape preparation of the colony surface may be done for speciation purposes. This should be stained with lactophenol cotton blue (or the blue dye from a DiffQwik™ stain).

Biopsies – This is not a normal method of diagnosis, but if positive, a quicker method than culture. Usually this is the method of diagnosis when a dermatophyte infection is not being considered and the biopsy was taken for other reasons. Special stains help to identify fungal organisms in tissue.

**Treatment**

Itraconazole (10 mg/kg once daily) is an anti-fungal triazole compound. It has been considered the first drug of choice in the treatment of feline dermatophytosis. It is lipid-soluble and best given with food to enhance intestinal absorption. Cats tolerate itraconazole better than ketoconazole, although they may rarely develop hepatic toxicosis and anorexia. Ketoconazole at 10mg/kg is the preferred drug for dogs. Neither drug should not be used in pregnant animals; adverse effects in kittens have not usually been observed. Itraconazole comes in 100 mg capsules (Sporanox®; Janssen). The capsules contain small pellets that can be put into food. This is especially useful in treating cats: a capsule’s pellets are mixed with a tablespoon of butter, frozen, and the butter then ‘halved’. Each quarter contains 50 mg itraconazole, which is the standard dose for a 5kg cat. Alternatively, Sporonox® is available in a pediatric suspension (10mg/ml), but this is rather expensive. There are various regimens recommended for this drug, including 15 days on, 15 days off (during the last 5 days of which, a fungal culture is repeated), then 15 days on until cultures are negative; another regimen is 28 days on, then alternating weeks on and off until cultures are negative.

Fluconazole is available as a generic. The author has used it at 5mg/kg q12 hr to good effect in several cats. It is less expensive than itraconazole and well tolerated. It is mainly metabolized in the kidneys, so should be used with caution in cats with reduced renal function.

Terbinafine (Lamasil®: Novartis, also available as a generic) is an allylamine antifungal agent. It is well tolerated by cats and should be administered at a dose of 30-40 mg/kg orally once daily. It may be used in dogs and cats. It has successfully treated a dermatophyte (pseudo-) mycetoma. It has not caused problems in pregnancy in humans.

The value of clipping dermatophyte-infested cats has been questioned: clipping may spread the organism and provide it access through an abraded epidermis. Lime-sulphur (Sulfurated Lime, Dechra Overland Park, KS 66211 USA at 1 cup to a gallon of water is also an effective topical treatment modality. Topical miconazole shampoos and leave-on conditioners have become more popular than older topical antifungal products. Patient compliance is, needless to say, a concern.

Treatment of the environment – often difficult (infected hairs may contaminate the environment for up to 1 year!). Minimally, all bedding should be disposed of, as should all air filters. Vacuum exposed areas thoroughly on a daily basis. Use 10% bleach on nonporous surfaces daily, and soak grooming tools in 10% bleach or discard. Clip long-haired cats or cats with generalized disease (#10 blade) – controversial.

In cases of multipet households, catteries, or shelters, there are two excellent articles. Briefly put, in the latter study a three-area system was used: healthy animals (no lesions and negative cultures), subclinical carrier animals (no lesions but with positive cultures) and clinically affected animals (lesions and positive cultures). The cats were examined and inspected under a Wood's lamp and had samples taken for fungal culture every 2 weeks. Thirty-three per cent of the cats had a positive fungal culture at the start of the study. Clinically affected animals and carriers were treated with a 0.2% enilconazole lotion (Imaverol – not available in the USA) twice a week and given itraconazole 5 mg/kg once daily orally every other week. The environment was treated once a day with a 1% bleach solution and once a week with a 0.6% enilconazole (Clinafarm) solution. Treated animals were considered cured after two consecutive negative fungal cultures. All cats were cured within 56 days. No relapses were observed based on the fungal cultures taken from the cats and the environment over the first 10 months.

**Malassezia**

In dogs, *Malassezia pachydermatis* is primarily seen in dogs with atopic dermatitis. Various species of this organism have been cultured from cats (*M globosa, M furfur, M pachydermatis, M nana* and *M sympodialis*). The organism has been isolated from the skin and ear canals of healthy cats as well as from cats with dermatitis and otitis. Demonstration of the organism has been done by culture, histopathology and direct examination of skin swabs, skin scrapings, impression smears, ‘sticky’ slides and tape strips. In cats widespread *Malassezia* dermatitis may be associated with atopic dermatitis, food allergy, an internal neoplasia (thymoma, adenocarcinoma of the pancreas) cutaneous lymphoma, or pemphigus foliaceus.

**Diagnosis**

This organism may be demonstrated many ways. The author feels most comfortable with a clear (Scotch®) tape preparation, by pressing the tape against the area affected, then placing the tape on a dry microscope slide. Staining of the tape is effected by injecting a small amount of the third (blue) solution of a stain like Diff-Qwik® under the tape. The slide should be scanned under low power for areas of debris; these should then be examined under oil immersion. Finding more than five yeast in ten fields is suggestive, in the author's opinion, of at least a contributory role of the organism to the clinical presentation.
Systemic treatment is preferred: itraconazole, fluconazole or ketoconazole at 5 mg/kg q24h. Terbinafine (30,g/kg q24h would probably be effective as well. Treatment should be for at least 1 month. As a reminder, griseofulvin has NO effect on Malassezia or any other yeast.

Sporothrix schenckii

This agent of sporotrichosis survives in the environment and becomes pathogenic in animals as a result of the dimorphic abilities of the organism; this dimorphism is the conversion from a yeast-like form at temperatures between 35 and 37°C to a mycelial phase (with branching, septate hyphae) at environmental or laboratory temperatures of 25 to 30°C. It is more common in cats than dogs.

Outdoor animals are exposed to S schenckii via wound contamination or penetrating foreign bodies. The three clinical syndromes of sporotrichosis are localized cutaneous, lymphocutaneous, and multifocal disseminated sporotrichosis. Among cats, the lymphocutaneous and localized forms are the most common and important tozoonotic transmission. Subcutaneous lesions generally develop in association with the lymphatic chain and are detected initially as nodules that are painful upon palpation; these eventually ulcerate and a supplicative lymphadenitis develops. Exudate from these lesions is usually thick and brownish red. Cutaneous lesions of sporotrichosis are most often observed on the legs, face, or nasal planum. These may be very ulcerated. Localized cutaneous sporotrichosis is confined to the area of inoculation and develops after an incubation period of approximately 1 month. There may be regional multicentric lesions. If the localized cutaneous form is not treated, it may be progress to the lymphocutaneous form. The lungs and liver are the primary sites for dissemination of S schenckii. FIV or FeLV infection as a predisposing cause of sporotrichosis in cats seems uncommon. Rarely, the organism may be found on blood smears of infected cats.

A unique aspect of sporotrichosis in cats is the large number of yeast-like cells detected in the subcutaneous lesions compared with that detected in lesions in other species. Because S schenckii organisms have distinctive cytologic features, sporotrichosis in cats is often diagnosed via cytologic evaluation of samples obtained from aspiration of abscesses or nodules, impression smears of ulcerated skin or exudate, smears of swab specimens, or skin scrapings. Smears are air-dried and stained with Wright’s or a Romanowsky-type stain. These contain high numbers of yeast-like organisms that are usually round to oval, often described as cigar-shaped but may appear as roundbudding yeast. This large number of yeast-like cells in lesions of cats, as well as the isolation of the organism from cats’ claws, may contribute to the greater zoonotic potential of feline sporotrichosis, compared with that associated with the disease in other domestic animals. Rarely, the organism is only able to be demonstrated via culture.

Results of fungal culture of specimens from lesions are needed for definitive diagnosis of sporotrichosis in humans and animals. This dimorphic fungus is usually isolated from swabs or biopsy specimens obtained from lesions via culture on Sabouraud mycologic medium when incubated at both 25 and 37oC for 10 to 14 days. In this manner, both the yeast and mycelial forms of S schenckii are identified, which is necessary for definitive diagnosis of sporotrichosis. Special stains usually are needed to identify the yeast structure of S schenckii in tissue sections.

Itraconazole has been considered to be the drug of choice in cats. The drug is well absorbed after oral administration and widely distributed to tissues, including skin, where it achieves concentration much greater than that in plasma. Itraconazole is administered orally 5 to 10 mg/kg every 12hours, preferably with food that increases absorption. Treatment should be continued for 1 month after apparent clinical cure to prevent recurrence of clinical signs. The author has used fluconazole in one cat with good results.9a It has been speculated that the combination of an azole and terbinafine could lead to faster cure.

References