

Taking the “Ahh” Out of the Diagnosis and Treatment of Dermatophytosis

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Feline dermatophytosis is a superficial fungal skin disease of cats. The disease is not life threatening and is treatable and curable. The disease will also spontaneously resolve without any treatment in otherwise healthy animals. Severe disease is the result of severe physiological stress and the disease will self-cure if and when the underlying disease resolves. This disease has recently been reviewed in detail.¹

The primary pathogen of cats is *Microsporum canis*. This organism is not part of the normal fungal biome of cats and therefore isolation indicated true disease or fomite carriage. Less frequently *Trichophyton sp* and *M. gypseum* can cause disease in cats. *Trichophyton sp* infections in cats tend to occur in the fall and winter months and are most common in cats or kittens that are housed outdoors, are ‘hunters’, and/or are have exposure to large animals. Care must be taken when these two pathogens are isolated from a toothbrush culture as fomite carriage is common, especially with *M. gypseum* which is a soil based organisms.

Disease prevalence is hard to determine from published studies because of different methodologies. Many of the studies were published before awareness of the fact that *M. canis* is not part of the normal flora of cat hair and the issue of fomite carriage. Electronic medical record review found that feline dermatophytosis was not a common disease, occurrence 0-<4% of skin cases and was not even one of the top 10 skin diseases of cats. A review of risk factors found that the most at risk populations were kittens, stray cats, cats from hoarding situations, and outdoor cats. The use of immunosuppressive drugs was not a risk factor nor was positive retrovirus status alone in an otherwise healthy cat. Persian cats are at increased risk for subcutaneous nodular lesions.

One of the most important ‘new’ findings about *M. canis* dermatophytosis is that the primary mode of transmission is via direct contact with another infected animal. The successful establishment of an infection requires all of the following to occur: exposure to an adequate quantity of infective material, evasion of the host defense mechanisms, e.g. grooming and antimicrobial properties of the skin, skin micro-trauma, and moisture. It is RARE for people to contract *M. canis* infections from the environment (1 published case report) in the absence of direct animal contact. The major reason for cleaning is to remove spores from the environment that could otherwise cause fomite contamination and interfere with monitoring of response to treatment.

With regard to clinical signs, it is important to remember that the statement “It’s ringworm until proven otherwise is untrue”. The most common cause of skin lesions in cats are due to parasites.

With respect to how dermatophyte lesions appear, individual lesion presentation reflects disease pathogenesis. Early infected hairs may appear normal unless examined by a Wood’s lamp tool. As the disease progresses hair loss, scaling, crusting, hyperpigmentation and pruritus may all develop.

From a more practical perspective, given that the presentation of the disease reflects the global health of the cat infections are best considered as “simple”, “complicated” or “culture positive-lesion free”.

Simple infection: This group consisted of otherwise healthy cats or kittens with confirmed infections. Lesions were obvious but limited in extent. Cats responded well to a wide variety of treatment protocols and/or the disease rapidly cured without treatment.

Complicated infection: This group consisted of cats with wide spread lesions, inflammatory lesions, long-haired/matted hair coats, other illnesses (most notably upper respiratory infections), a history of prior treatment, surrender for “resistant dermatophytosis”, and/or are semi-feral or feral cats. These cats required more prolonged treatment and repeat courses of treatment to achieve mycological cure. These cats did not cure until their overall health was ‘normal’.

Lesions Free but Culture Positive Group: : This group of cats consisted of cats mechanically carrying spores on their hair coat (i.e. “dust mops”) or cats with very early lesions that were not easily seen but mature enough to be shedding arthrospores. Fungal culture results coupled with a re-examination under both white light and a Wood’s lamp are helpful to differentiate fomite carriers from cats with early lesions; however, fomite carriers were most often identified by a rapid change in culture status from positive to negative with topical therapy alone provided they were in a clean environment.

There are only two tests that truly confirm active infection: direct examination of hairs and skin biopsy of a lesion. The Wood’s lamp and the dermoscope are tools, just like a microscope, that are used to find suspect hairs for direct examination or fungal culture. Skin scrapings and hair pluckings of lesions are diagnostic sampling techniques used to find hairs for microscopic evaluation. Fungal culture merely detects spores on the hair coat. PCR detects fungal DNA on the hair coat.

Skin biopsy a diagnostic TEST that is indicated in cats with nodular lesions or with dramatic skin lesions for which point of care tests do not find a diagnosis. It is not a routinely performed test but when done the sample size obtained should be 6 to 8 mm in size. There is approximately 50% shrinkage of samples in formalin and anything smaller is going to be non-diagnostic. Do not prepare the skin surface or alter it as key findings for dermatologic diseases are found in the skin surface. Submit several samples and be sure to inform the laboratory of the differential diagnosis list, particularly that a dermatophyte is suspect.

Direct examination is a simple diagnostic TEST where hair shafts are examined for the presence or absence of infected hairs. Suspect hairs can be found using a Wood’s lamp tool (see below), dermoscope (see below) or via skin scraping (See below). Normal hairs appear thread-like and abnormal hairs appear pale, wide and filamentous. Infected hairs are easily found at low power.

A recent study found that the best diagnostic sampling technique whether a lesions was Wood’s lamp positive or not was to use mineral oil and a combination of plucking of hairs from the margins of a lesion and scraping of the lesion with a skin scraping spatula. This test detected >87% of *M. canis*, *M. gypseum* and *Trichophyton spp* infections in dogs and cats. Clearing agents were not helpful. Mineral oil is preferred because it also allows for the dual examination of the specimen for mites and hair shafts for dermatophytosis.

Wood’s lamp examination is a point of care TOOL that is used to find fluorescing hairs of *M. canis* for direct examination and/or culture. The best used lamp is plug in with built-in magnification with a wave length of 320 to 400nm. A recent evidence based review of diagnosis and treatment of dermatophytosis found the Wood’s lamp is an good diagnostic tool for finding infected hairs. Studies reporting low fluorescence were retrospective reference laboratory studies looking at randomly submitted samples over decades. When studies on live animals were examined 100% of experimentally infected animals had positive fluorescing hairs and in cat with spontaneous disease 91% had positive fluorescence. As treatment progressed, fluorescence declined (as expected). It is important to hold the lamp close to the skin 2-4 cm, start at the head, move slowly, and remember to look under crusts for glowing hairs. Newly infected hairs are very short. Tips and tricks are detailed in an open access reference.²

Dermoscope is a point of care TOOL for finding hairs for direct examination and/or culture. It is a hand held lighted magnifying device that can be attached to cell phone. It is used to find abnormal hairs which appear as pale and broad.

Fungal culture merely detects the presence of spores on the hair coat of a cat and needs to be interpreted in light of clinical history and clinical findings. The toothbrush culture technique is recommended. ONLY the suspect lesion should be cultured and it should be aggressive enough to see hairs in the bristles. A recent study found that samples should be inoculated directly onto the surface of a flat fungal culture plate. Hairs should not be removed from the bristles as this resulted in contamination and false negatives. Poor sampling technique can result in false negative test results. Do not OVER inoculate the surface of the plate as this may result in lack of sporulation as fungal hyphae compete for nutrients.

PCR testing is relatively new. The test advantage is that results are available within days and not weeks. Samples should be taken only from suspect lesions. Hairs and crusts should be submitted. Inadequate sample submission is a major reason for false negative test results. If used for monitoring, bathe the cat prior to testing to remove any non-viable fungal DNA.

2019 TREATMENT RECOMMENDATIONS AND OPTIONS

Confinement: Contrary to popular Dr. Google cats the reason cats are confined are to keep them physically safe and to decrease the living area that needs to be cleaned. Infection risk from a contaminated environment is not efficient and is hard to document. Confinement to an easily cleaned room shortens overall treatment time. Review of the literature on animal welfare, quality of life and socialization of kittens and cats requires that veterinarians reassess this recommendation and give clients very specific instructions. Dermatophytosis is most common in kittens during the critical socialization period and proper socialization of a new cat into a home is necessary so both remain in a permanent and loving home. Most cases of dermatophytosis are in cats that are new additions to the home. Confinement can be limited to what the owner would do normally when adding a new cat to a home, i.e. kitten proof space while they are at work etc. Frequent use of topical therapy will disinfect the hair coat and minimize the amount of infective material on the coat. Owners can socialize with kittens and cats using safe precaution. If children are in the home, care should be taken to educate them on how to safely play with the kitten under supervision and minimize direct contact. **With early disease detection, removal of shed hairs via combing, consistent and frequent topical therapy, and systemic therapy confinement can be limited to a short period of time.** Topical therapy is protective against contact with the spores especially if lime sulphur is used.

Cleaning: Contrary to popular Dr. Google facts show that cleaning and disinfection is relatively easy, and spores do not live for years. A major myth in the literature is that the spores live for years in the environment. This statement was extrapolated from a laboratory study where 3 of 6 specimens stored for 18 to 24 months sporulated on fungal culture medium. The primary reason to clean is to minimize environmental contamination that can lead to positive fungal culture or PCR results from fomite carriage in cured cats. **Review of the literature revealed that confirmed reports of transmission of the disease from a contaminated environment to a person in the absence of contact with an animal are rare.** Points to emphasize with clients:

- Fungal spores do not 'live' in the environment and do not multiply. They do not invade and grow in any of the home surfaces. Spores can only live in keratin.
- Fungal spores are like dust, not like mildew.
- Fungal spores are EASILY removed by mechanical cleaning and washing with a detergent and water.
- Culturing of the environment is not needed unless there is concern about false positive fungal culture results.
- These spores do not represent a respiratory risk. This is caused by overgrowth of different fungi living in the home due to excessive moisture.
- It is very likely that they or someone they live with has or had human dermatophytosis, the most common being 'toe nail fungus.' In addition, there is no need for alarm about exposure to spores as many studies have shown people are exposed to 'ringworm spores' in many environments including but not limited to: their homes, other homes, gym, pools, doctor's offices, the beach, airports, etc.
- This is a zoonotic disease but compared to other zoonotic diseases it is not life threatening or life changing.

In practice, if it can be washed it can be disinfected. Exposed laundry need only be washed twice until no visible hair is present. Evidence based studies have shown that cold water without bleach is just as effective as hot water and bleach. With regard to 'hard surfaces' the key steps are to tell clients to clean as 'if company is coming' or as 'if they are cleaning up vomit or feces'. Specifically, mechanical removal of

debris, washing of the surface with an over the counter detergent until visibly clean, rinse the surface to remove detergent residue which can inactivate a disinfectant, remove excess water which can dilute a disinfectant, and then careful use of a disinfectant. Regarding the type of disinfectant, studies have shown that any over the counter bathroom cleaner with label claim as efficacious against *Trichophyton* is effective. MOST homes need daily changes of bedding, mechanical removal of debris with a Swiffer and once or twice wet cleaning. Do not use bleach as this is an irritant and human health hazard and better ready to use products are available.

Assessment The first and most important aspect of monitoring is looking for and attaining a clinical cure. In otherwise health cats lesions will often start resolving within one or two weeks. Lack of a clinical response is an indicator of treatment failure for some reason. Given that this is a self-curing disease, if the client is administering treatment as directed, there may be some underlying disease or physiological stress, or possibly a secondary untreated disease. Wood's lamp tools are very helpful for monitoring response to treatment. Prior to the wide availability of fungal cultures, the most common method to monitor response to treatment was via a Wood's lamp examination. Detailed reports of the development and resolution of infections are consistent. During the early stages of disease, the proximal part of the hair shaft showed fluorescence. As the infection progress the entire shaft develops fluorescence and with eradication of the infection, it is lost in the proximal part of the hair shaft. As the cure progresses and the hair recovers, hair shaft fluorescence proceeds up the shaft until only the tips glow. These findings have been confirmed in experimental infection studies and field studies.

The next step in monitoring is to treat until mycological cure. There is no consensus on what constitutes mycological cure, i.e. how many cultures and at what intervals. The current literature recommends two negative cultures taken at two week intervals but this is not based upon any study or data and was made in 1959. In a recent unpublished review of the treatment of >300 shelter cats, the author found that in cats with simple infections the first negative culture was predictive of mycological cure. Given the sensitivity of PCR, a single negative PCR indicated mycological cure assuming adequate sampling. If the PCR is positive a toothbrush fungal culture should be obtained to determine if detected fungal DNA is viable or not.

Topical Therapy: Topical therapy is a non-optional part of the direct treatment of the infection. It is the part of therapy that disinfects the hair coat, directly protects people and other susceptible animals from disease transmission, minimizes the risk of satellite lesion development, and minimizes environmental decontamination. Two studies found that the use of topical therapy prevented environmental contamination within one week of starting treatment. Topical therapy recommendations include the following:

- Comb the hair coat to remove any easily shed hairs; use of disposable plastic comb is ideal.
- Apply topical therapy twice a week
 - Whole body rinses include lime sulfur (1:16) or enilconazole (1:100); do not rinse off. Whole body rinses are recommended in homes where there are children or where there is a high risk of contagion to other animals or people.
 - The best shampoo alternative is a 2% chlorhexidine/2% miconazole shampoo; shampoo therapy does not have any residual effect.
- Use concurrent focal topical therapy for hard to treat areas
 - Apply 2% vaginal miconazole to lesions on the face once daily along with twice weekly topical therapy.
 - Apply an ear otic solution containing miconazole/chlorhexidine or ketoconazole/chlorhexidine to disinfect hairs in and around the ears.
- For cats that cannot be wetted, climbazole/miconazole or chlorhexidine/miconazole leave on mousse can be used.

Systemic Therapy: The drug of choice for the treatment of feline dermatophytosis is NON COMPOUNDED itraconazole. It is available as a liquid formulation. This drug is safe and in a review of 11 studies, excluding the study conducted in the United States for licensing, there were no published reports of cats being treated for dermatophytosis that developed liver toxicity and died. The recommended treatment dose is 5 mg/kg orally on a week on/week off protocol for an initial six weeks or longer until mycological cure. Most cats will cure with six weeks of treatment. The reason the drug can be used on a pulse dose protocol is that it accumulates in the keratin in antifungal levels for prolonged periods of time.

1. Moriello KA, Coyner K, Paterson S, et al. Diagnosis and treatment of dermatophytosis in dogs and cats.: Clinical Consensus Guidelines of the World Association for Veterinary Dermatology. *Vet Dermatol* 2017;28:266-e268.