THE SCIENCE WORLD
A Monthly e Magazine
ISSN: 2583-2212
June 2022; 2(6), 661-669

Popular Article

Dermatophytosis in Canines and Felines

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DOI: https://doi.org/10.5281/zenodo.6659583

Abstract

Dermatophytosis is one of the most common superficial fungal diseases in dogs and cats. Dermatophytes are a group of keratinolytic fungi which includes 7 genera namely Microsporum, Trichophyton, Epidermophyton, Nannizzia, Arthhroderma, Paraphyton and Lophophyton. The main etiological agents in canines and felines are Microsporum canis (zoophile), Nannizzia gypsea (geophile), and Trichophyton mentagrophytes. Direct contact with infected animals, humans, or fomites is the most common mode of transmission. Multifocal alopecia, mild or severe pruritus, and round scaly lesions with erythematous and scaly borders are common clinical signs. Dermatophytosis is diagnosed using a combination of clinical history, physical examination, and diagnostic tests such as Wood's light, direct microscopic examination of infected hairs and/or crusts, fungal culture, and biopsy. Dermatophytosis in dogs and cats requires a combination of topical, systemic, and environmental disinfection to be successfully treated.

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Introduction

Dermatophytes are keratinolytic fungi that infect animals and humans, causing superficial skin disease. They're regarded as a serious issue in shelter animals and household pets. Microsporum canis (zoophile), Nannizia gypsea (geophile), and Trichophyton mentagrophytes are the most common dermatophytes that affect small animals (zoophile). They are spread by cats (M. canis), soil (N. gypsea), and rodents (T. mentagrophytes) and can be transmitted by carriers or infected animals (Moriello KA et al., 2017). Dermatophytes are spread either directly or indirectly through contact with infected animals or contaminated objects such as furniture or grooming tools. For zoophiles like M. canis, the arthrospores attached to the hairs shed by infected animals are the main sources of infection. These arthrospores attach to the epidermis of a susceptible host and produce hyphae that infect the stratum corneum and hair. Infected animals are more likely to be young, stressed, or geriatric. (DeTar LG et al., 2019). The majority of infections in cats are caused by M. canis, but most infected cats recover mycologically within three weeks of receiving appropriate treatment (Moriello KA et al., 2020).

Dermatophytosis in dogs has a prevalence of 4 to 10%, but this can vary depending on regional differences and other epidemiological factors (Cabanes FJ *et al.*, 2000). Young dogs, aged 6-18 months, are more susceptible to infection than dogs older than one and a half years, followed by those older than three years (Singathia R *et al*., 2014). Male dogs are more likely to become infected than female dogs (Singathia *et al*. 2014 and Bhardwaj *et al*. 2012). Yorkshire terriers had a statistically significant higher incidence of infection, especially that caused by *M. canis*, than other breeds, indicating breed predispositions in canine dermatophytosis (Bhardwaj *et al*. 2012). The prevalence of a specific agent in small animal dermatophytosis can be influenced by seasonal variations. *M. canis* ringworm was more prevalent in the fall/winter season, whereas *N. gypsea* was more prevalent in the spring and summer (Lewis DT *et al.*, 1990).

2. Predisposing Factors to dermatophyte infection

- Young age (first 2 years of life)
- Immuno-suppression (including immunosuppressive treatment)
- Nutritional deficits (especially vitamin A)
- High temperature and humidity
- Skin trauma
- Injury from scratches or ectoparasites
- Aggressive behaviour
- Poor hygiene conditions
- Overcrowding in catteries

3. Clinical signs

Multifocal alopecia, mild or severe pruritus, and round scaly lesions with erythematous and scaly borders are common clinical signs. Other clinical forms of dermatophytosis include:

3.1. Folliculitis

Folliculitis is caused by dermatophyte infection of the hair. It appears as papules and pustules that rupture quickly, leaving epidermal collarettes, alopecia circularis, and crusts.

3.2. Nodular Lesions

Inoculation of dermatophytes into the dermis by accident (for example, during an injury) can cause a severe inflammatory response and the formation of a nodular lesion known as a kerion (Cornegliani L *et al*., 2009). It's a severe localised inflammation with swollen, boggy skin and pus oozing from it. It's frequently associated with secondary bacterial infection and appears on the face and limbs of hunting dogs who spend a lot of time outside in direct contact with the ground (Cafarchia C *et al*., 2004). This nodular lesion is most commonly found on the bridge of a dog's nose in dogs who used to dig in the dirt. The most common species associated with the development of kerion are *N. gypsea* and *T. mentagrophytes*. The severe inflammatory response

can last even after the dermatophytes have died. Dermatophytic mycetoma, also known as pseudo-mycetoma, is another manifestation of dermatophyte-caused nodular disease. This uncommon dermal/subcutaneous infection mostly affects Persian cats and manifests itself as nodules with draining tracts on the back. These cats usually arrive in hospitals with a history of antibiotic resistance.

3.3. Nail Lesions

Dermatophytes can also harm the pads of the feet and the nails. Nails infected with dermatophytes become brittle and deformed, especially in dogs infected with *N. gypsea* (Moretti A *et al.,* 2013).

4. Diagnosis

Dermatophytosis is diagnosed using a combination of clinical history, physical examination, and diagnostic tests such as Wood's light, direct microscopic examination of infected hairs and/or crusts, fungal culture, and biopsy (Gross TL *et al*., 1992).

4.1. Wood's Lamp

The use of a Wood's lamp as a screening tool is still recommended, and it is now widely accepted that most *M. canis*-infected clinical samples will fluoresce apple green under a Wood's lamp. It can be used as a screening test to determine whether or not an animal is infected with *M. canis*. This technique's percentage positivity ranges from 91 percent to 100 percent (Moriello KA *et al*., 2017). The presence of a tryptophan metabolite causes fluorescence to develop under UV light. After the first week of infection, the ability to fluoresce develops, and it can last at the tip of the hairs even after the infection is gone. When using Wood's lamp, clinicians should be cautious. Starting at the patient's head and slowly moving back while holding the lamp close to the skin (2 to 4 cm above the skin), distinguishing the green fluorescence of dermatophytosis hairs from the false blue fluorescence associated with scaling and some topical products (Moriello KA *et al*.,2017).

4.2. Direct Microscopic Examination

After treatment with 1-2 drops of 20 percent KOH on a clean glass slide, clinical samples such as hair and epidermal scales/debris are examined for characteristic spores (arthrospore) or hyphae. For better visualisation, any clumps should be teased with a teasing needle before placing the cover glass. The slide should be gently warmed over a flame after placing the cover slip and allowed to cool for 20 minutes at room temperature. After that, the slides are examined at 10 X and 40 X magnifications. The presence of septate hyphae and the distribution of spores inside (endothrix) or outside (ectothrix) the hair should be noted during microscopic examination of

clinical samples.

4.3. Fungal Culture

For dermatophyte isolation, clinical samples are inoculated on suitable fungal media such as Sabouraud dextrose agar or Potato dextrose agar. To prevent saprophytic fungi and bacteria from growing, the media should be supplemented with cycloheximide and chloramphenicol, respectively. Incubate the inoculated media for up to 45 days at 25-30 ^{o}C. *Microsporum* and *Trichophyton* spp. colony morphology is as follows:

Dusty, grainy colonies with a cottony surface and a yellowish-orange colour are formed by *Microsporum* spp. It produces pyriform, fusiform, or cylindro-fusiform macroconidia with echinulate or verrucous walls and 1–15 septa that are moderately thick to thick, with a size of 6–150 by 6–26 μm. It has sessile or clavate microconidia that are borne in clusters or directly on the hyphae (Molina de Diego A *et al.,* 2011).

Trichophyton spp. have a variety of macroscopic characteristics that differ between species; for example, the colonies can be grainy, cottony, cerebriform, or hairy. Reddish or brownish pigmentation can be found on the colonies' undersides. When present, macroconidia have smooth, usually thin walls with 1–12 septa, clavate to fusiform, that are either individual or clustered. Their dimensions range from 8 to 85 by 4 to 14 μm. Microconidia have a spherical, clavate, or fusiform shape, are sessile, and are borne laterally directly on the hyphae or in pedicels and are more abundant than macroconidia (Molina de Diego A *et al.,* 2011).

4.4. Skin Biopsy

Because cultures are frequently negative, skin biopsy for the diagnosis of canine dermatophytosis is only used for kerion reactions and granulomatous infections. However, this method does not allow for the identification of the dermatophyte's species. Common stains like haematoxylin and eosin (H&E) aren't very sensitive, so special stains like periodic acid Schiff (PAS) and Grocott methenamine silver (GMS) are required (Moriello KA *et al.,*2017). The lesion is described histologically as a nest of ruptured hair follicles replaced by suppurative to pyogranulomatous inflammation, with eosinophils oriented around hair fragments containing fungal hyphae and surrounded by fungal spores.

4.5. Molecular techniques

Molecular techniques are commonly used to differentiate the species and strains of dermatophytes. Various types of PCR, restriction fragment length polymorphism (RFLP), amplified fragment length polymorphism (AFLP), sequencing of genomic regions and MALDI-TOF are commonly employed in research laboratories. Genotyping of isolates based on

conserved regions like ITS (internal transcribed spacer region), beta-tubulin and TEF (translation elongation factor) regions will help us to understand the inter- and intra-species variations.

5. Treatment

Dermatophytosis in dogs and cats requires a combination of topical, systemic, and environmental disinfection to be successfully treated.

5.1. Topical Treatments

Because dermatophytosis is spread through contact with arthrospores, topical therapy is a critical component of small animal dermatophytosis treatment. Topical treatment aids in the resolution of infection and reduces arthrospore shedding into the environment.

5.1.1. Clipping

Hair clipping was once thought to be an important part of treating dermatophytosis in dogs and cats; however, it is now being reconsidered because whole-body clipping is stressful, and common micro-trauma to the skin can exacerbate the infection. Clipping is not necessary for short-coated animals, so it should be decided on a case-by-case basis (Moriello K *et al*., 2013).

5.1.2. Dips, Shampoos, and Rinses

Dips in lime sulphur are a common topical treatment for dermatophytosis. The effectiveness of lime sulphur dips has been documented in several studies, with twice weekly application being more effective than once weekly application (Moriello K *et al.,* 2013). Shampoos have a shorter duration of activity on the coat than dips. Dryness and yellow discoloration of the skin and hair coat are common side effects of lime sulphur. Recent studies have ruled out the possibility of oral ulcers in people who lick their wet coats (Newbury S *et al*., 2007). The majority of current veterinary lime sulphur formulations contain 97.8% saturated lime sulphur, which is applied at a dilution of 240 ml per 4.54 L of water (Moriello K *et al.,* 2013). Due to their ease of use, shampoos are the most popular choice among pet owners. The most effective topical treatment is a two-weekly application of miconazole and chlorhexidine (Moriello KA *et al*.,2017, Moriello KA *et al.,* 2020). Despite the fact that chlorhexidine has antifungal properties, its efficacy for dermatophytosis has been demonstrated to be poor (DeBoer DJ *et al.*,1995)

5.2. Systemic Treatments

Drugs that are keratinophilic and lipophilic and accumulate in the skin and keratin are the best choices for systemic therapy. Oral itraconazole or oral terbinafine are currently the most effective systemic treatments for both canine and feline dermatophytosis (Moriello KA *et al.*, 2017).

5.2.1. Itraconazole

In cats, itraconazole has a long half-life and a high proclivity for accumulating in hair and skin. This property allows for the use of pulse therapy, which lowers therapy costs. Clinical success has been demonstrated by daily administration for one week, followed by one week on and one week off. After giving the drug daily for four weeks, a pulse regimen can be started. Itraconazole is most commonly given to dogs and cats at a dose of 5 mg/kg once daily. Because itraconazole affects cytochrome P450, it's important to think about drug interactions and reduce the doses of other medications if this interaction affects their metabolism (for example, cyclosporine) (Colombo S *et al.,* 2001, Liang C *et al.,* 2016, Puls C *et al*., 2018).

5.2.2. Terbinafine

Because terbinafine is highly keratinophilic and accumulates in hairs, it can be used in pulse therapy, reducing costs and side effects. It has excellent anti-dermatophyte activity, and one study found that it is effective and could be a suitable and less expensive alternative for shelter cats. Terbinafine is commonly given at a dose of 20 mg per kilogramme once daily (Kotnik T *et al.*,2001, Foust AL *et al*.,2007). Although terbinafine does not have the same effect on cytochrome P450 as azoles, it does involve the liver in its metabolism, so liver function monitoring may be required if treatment is prolonged.

5.2.3. Ketoconazole

Although ketoconazole is effective against dermatophyte infection, it is not as effective as itraconazole or terbinafine as a treatment option. Ketoconazole has been used in cats, but it is best reserved for dogs because it is not well tolerated in cats and frequently causes anorexia and nausea. Ketoconazole is usually given to dogs at a dose of 5 mg/kg PO every 12 hours, and it is best given with food to reduce side effects and increase absorption (Medleau L *et al.,* 1992).

5.2.4. Fluconazole

Fluconazole has poor in vitro activity against dermatophytes and is no longer recommended for dermatophytosis treatment (Begum J *et al*., 2020).

5.2.5. Griseofulvin

Griseofulvin has long been used to treat dermatophytosis, but there are now safer and more effective alternatives. As a result, griseofulvin is rarely used as a treatment option.

5.3. Environmental decontamination

In the treatment of dermatophytosis, environmental decontamination is crucial. It also reduces the number of fungal culture results that are falsely positive. Despite the fact that separating animals for the purpose of reducing contamination has been advocated for decades,

confinement must be done with caution because it can be extremely stressful for animals, especially young ones. As a result, the length of isolation should be kept to a minimum in order to decontaminate the environment. Weekly cleaning and topical therapy can help to reduce the need for prolonged isolation (Newbury S *et al.*, 2015). Weekly cleaning has been shown to be very effective in removing infective arthrospores in studies. The actual hard cleaning, which involves the removal of debris and hairs, is the most important part of the decontamination process. Over-the-counter household detergents can be used to clean. Hard surfaces can be disinfected with a 1: 100 solution of household bleach or accelerated hydrogen peroxide. Soft fabrics should be machine washed on the longest cycle possible to maximise spore removal (Moriello KA *et al*., 2013, Moriello KA *et al.*,2015, Moriello KA *et al.*, 2019).

Conclusion

Dermatophytosis is a zoonotic disease that can be treated. A step-by-step logical approach is critical for proper diagnosis of patients with folliculitis or alopecia. A combination of clinical signs and positive fungal culture results can be used to make a diagnosis. Positive panderm PCR or culture results in the absence of clinical signs may simply indicate the presence of arthrospores on the coat without active infection. The source of the arthrospores should be determined because dermatophytes are not part of the normal flora. For quick screening of M canis infection, Wood's lamp examination is still recommended. The majority of patients who are affected require a combination of topical and systemic treatments. Itraconazole and terbinafine are the most effective oral medications. which can be used in conjunction with topical lime sulphur dips twice weekly and/or shampoos containing both miconazole and chlorhexidine. A combination of resolution of clinical signs and negative culture should be used to determine whether a patient is completely cured.

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Cite as

Jitendra Kumar Bagra1, Abhishek1, Sonu S. Nair1, Athira V1, Manish Kumar1, Prasad Thomas1, V. K. Chaturvedi1 and Bablu Kumar2. (2022). Dermatophytosis in Canines and Felines. The Science World a Monthly E Magazine, 2(6), 661–669. https://doi.org/10.5281/zenodo.6659583