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Ringworm (Dermatophytosis) in Cats

What is ringworm?

“Ringworm” is the common name given to a fungal infection of the superficial layers of the skin, hair, and nails. The name comes from the classic appearance of the round, red, raised ‘ring’ marking the boundary of inflammation in people infected with the disease. The fungi responsible for ringworm belong to a specialized group known as dermatophytes, and these organisms can cause disease in both humans and animals.

The most common fungal species that causes ringworm in cats is called *Microsporum canis*. This species accounts for >98% of feline infections. Two additional species that can play a role are *Microsporum gypseum* and *Trichophyton mentagrophytes*. The fungi live in hair follicles and cause the hair shafts to break off at the skin line. Transmission occurs via direct contact between infected and non-infected individuals, an infected environment, or grooming tools. The fungal spores (or infected hairs) may live in bedding or carpet for several months. The incubation period between exposure to ringworm and lesions on the patient ranges from 7-13 days.

Who gets ringworm?

Ringworm commonly causes lesions on the face, ears, and front paws of cats, but generalized, deep skin, and nail bed lesions are also possible. Itch level is variable with active infection, but most patients with ringworm are not particularly itchy. Ringworm can cause different lesions on a cat’s skin depending on the way an individual patient’s immune system responds to infection. Lesions tend to be asymmetrical and consist of circular areas of hair loss (alopecia) with broken barbered hairs and scale on the surrounding skin surface. Crusts, little red bumps (papules), and a generally unkempt greasy coat are less common presentations.

Persian cats are predisposed to ringworm infections, and it can be harder to treat infections in this breed. Long-haired cats, in general, have a harder time clearing the infection. Dermatophytic pseudomycetoma or a deep subcutaneous (underneath the skin) fungal infection has only been reported in Persian cats and may require surgical intervention for treatment. This type of infection presents as firm nodules or swellings underneath the skin. The skin surface can be ulcerated and the lesions are most commonly found along the back or near the tail base.

Age (juvenile and geriatric patients), pre-existing conditions that damage the skin barrier (allergic skin disease), or compromise the immune system (diabetes, pregnancy/lactation, stress, malnutrition, cancer, or certain medications) can predispose a patient to development of a dermatophyte infection.

The history provided will often include a cat recently acquired from a breeder, a cat adopted or fostered from the shelter, and/or a multi-cat household.

How is ringworm diagnosed?

There are two quick screening tests that can be performed when ringworm is suspected – examination under a Wood’s lamp (special ultraviolet light) and examination of infected hairs under the microscope (trichogram). 50-80% of feline ringworm infections will show a yellow-green fluorescence when the hairs are examined in a dark room with a Wood’s lamp. However, not all

cases show clear fluorescence and some dermatophyte species do not fluoresce under the light at all. In addition, other materials (saliva, dandruff, crust, topical medications) will fluoresce and may give a false positive result.

The most reliable test is performing a culture in a laboratory setting; the species of ringworm can be identified. Samples of hair and skin scrapings are taken. The Mackenzie toothbrush technique is used to brush the entire coat of the patient, focusing on the areas of scale and hair loss last (so the active infection is not spread to unaffected areas on the body). Culture results can take anywhere from 2-3 weeks, but there is usually an indication that a sample will be positive within the first week. Other causes of hair loss may have to be ruled out by additional testing, and both false positive and false negative cultures can occur. Treatment is continued until there are at least two negative cultures (1 week – 1 month apart, may require more cultures in multi-cat household or with recalcitrant cases).

Polymerase chain reaction (PCR) is a highly sensitive laboratory test that can detect even the smallest amount of ringworm DNA. Because of its sensitivity, there can be false positives (ex. even if it's not actually causing a problem for the patient and was just picked up briefly from the environment). If a patient is already under treatment, then this test is not recommended for monitoring purposes.

How is ringworm treated?

Ringworm is a treatable infection in most cats, with resolution taking anywhere from 2-6 months. The infection is usually treated with multiple therapies to minimize the risk of spread of infection to humans (especially children) and other pets. A combination of topical and oral therapy is most often used. Environmental decontamination is also very important to help prevent reinfection or spread to healthy individuals in the household.

Options for treatment – Regardless of which topical therapy is elected, twice weekly treatments are advised in most cases.

Topicals:

- 1. Lime sulfur** – This is one of the most effective topical treatments for ringworm available in the United States. It is inexpensive as well as safe for young animals and those with other health concerns. It is applied as a diluted dip, meaning the patient's skin and hair coat are covered until it dries on the skin/hair, rather than rinsed off. It has a very distinct egg-like smell and should be applied in a well-ventilated area. It can also stain clothing, porcelain, jewelry, and towels, so it is recommended that gloves are worn for application, and precaution is taken with any porous surface. Treatments are recommended 1-2x/week depending on the severity and extent of the infection. Adverse effects are uncommon, but skin irritation and dryness may occur; frequency of application can be adjusted if needed.
- 2. Terbinafine (Lamisil®)** – This 1% cream is available over-the-counter and is an option for spot treatment of focal lesions only. This treatment is well tolerated, but gloves should be used for application, and the cat should be prevented from licking at the site for 15-20 minutes after application.
- 3. Anti-fungal shampoos** – There are multiple options with various active ingredients (ketoconazole, miconazole, or miconazole/chlorhexidine combinations). Anti-fungal shampoos alone do not seem to be the best option for cure. They can be helpful for pets that may have only been exposed to ringworm but are not actively infected or when used in combination with oral medication. When shampoo is chosen over lime sulfur dips (in combination with oral medication), treatment time is significantly longer for patients using the shampoo options. Medicated bathing should be performed at least 2x/week and with a contact time of 10 minutes before rinsing.
- 4. Accelerated hydrogen peroxide rinse or dip** – In laboratory or shelter settings, these products show promise, but no studies have been performed to evaluate how patients with ringworm infections respond. There is also limited safety data for use directly on pets.

Oral therapy: Oral antifungals are used in combination with topical products for faster clinical cure. Compounded versions of these medications are ineffective (poor and variable bioavailability).

1. **Itraconazole (Itrafungol, Sporonox)** – This oral antifungal is considered the treatment of choice, but it can be expensive, especially for larger patients. The brand name versions of this medication should be used (no generics). It is available as a liquid or capsule and is generally given once daily for 3-4 weeks initially. Because this medication can concentrate in keratin structures (hair and nails), the medication can then be given in a pulsed fashion (2-3x/week or week on/week off) so that an effective concentration remains at the site of infection. If a patient has pre-existing health concerns or requires this medication long-term, then blood work is recommended, especially to look at liver function and overall health. This medication should not be used in pregnant or lactating animals. Very rarely, vasculitis (inflammation of blood vessels) or cutaneous drug reactions can occur.
2. **Terbinafine** – This oral antifungal is less expensive than itraconazole because the human generic can be used. Studies have shown that terbinafine can be as effective as itraconazole but only when used in conjunction with recommended topical therapy (typically lime sulfur dips). It is given once daily for at least 3-4 weeks and can then be given in a pulsed fashion (similar to itraconazole). This medication is generally well tolerated, but patients with pre-existing liver disease should have bloodwork performed. Vomiting or other gastrointestinal side effects are possible.
3. **Griseofulvin** – *This is an older anti-fungal medication that has largely been replaced by other medications. It can cause birth defects if used in pregnant animals. The drug tends to have more side effects, such as gastrointestinal upset and decreases in red and white blood cell counts. If this medication is used, bloodwork and symptoms should be monitored closely. Cats are particularly sensitive to the red and white blood cell side effects.*
4. **Fluconazole** – *This antifungal is not as effective as the ones listed above. Fluconazole may be considered if a patient has other health concerns or is taking other medications since it tends to have fewer drug interactions. Ketoconazole should not be given to cats due to concerns about liver toxicity.*

Environmental Decontamination:

- The focus of environmental decontamination is to protect other members of the household, to prevent reinfection, and to limit false positive fungal cultures. However, true infection from the environment is a rare event.
- Hairs infected with ringworm contain numerous microscopic fungal spores that can be shed into the environment, so removal of as much hair as possible from the environment is desirable.
- Although it may be helpful to limit the infected pet to an easy-to-clean space, confinement should only be used for the shortest time possible. Confinement can cause anxiety and stress which can lead to behavioral problems.
- The single most important aspect of environmental disinfection is vacuuming. Target areas should receive good suction for at least 10 minutes, and hard surfaces should be cleaned with a Swiffer or similar product.
- Concentrated chlorine bleach (0.5-5% sodium hypochlorite) is one of the few household chemicals with good antifungal activity against spores within hair shafts. Since concentrated bleach is not practical for household use, a 1:10 dilution is recommended for surfaces that are bleachable. The surface should stay wet for a total of 10 minutes to kill the ringworm spores. Bleach will not kill spores in the presence of dirt/hair so it is important that the surface be properly cleaned before it is bleached (“hard clean”).
- Laundering is an effective way to decontaminate household items such as bedding. Water temperature and bleach additive are not as helpful as agitation time, so use the longest wash setting, and do not overfill the machine to allow the most agitation. Washing

- machines and dryers are usually not contaminated, but the machines should be wiped with a dilute bleach or accelerated hydrogen peroxide cleaner after use.
- The ringworm fungus can remain infective in the environment for up to 18 months, maybe longer. This makes environmental cleaning equally as important as treating the infected animal.

What is the risk to humans?

Ringworm can be transmitted to humans, particularly children or any immunocompromised individuals, and it is important to take appropriate steps to minimize exposure to the fungus while the cat is being treated. If any humans in the house develop skin lesions, then a physician should be contacted for appropriate medical advice/treatment.

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