

INFECTIOUS DISEASE IN SHELTERS AND FOSTER HOMES: RINGWORM

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Ringworm in an individual pet cat may be a serious nuisance, but it's rarely life threatening. Self cure is common within a few months, and many treatments appear at least partially effective. Ringworm in an animal shelter, on the other hand, can lead to almost unmanageable outbreaks, thousands of dollars in diagnostic and medical costs, the possibility of spread of disease to adopters and staff, and an intolerable blow to shelter status in the community. In a foster home or cattery it can be immensely difficult to eradicate, leading to case after case in cats newly exposed to the environment. When working with small animal populations, therefore, it is vital to have a consistent and effective strategy to prevent and manage this disease.

What is *different* about managing ringworm in a population?

- Screening is a big deal – a missed lesion can be very, very costly
- Treatment has to be effective – it must work fast and protect the environment
- Confirmation of cure is critical – a missed fungus can be very, very costly
- Decontamination must be successful – future exposure of naïve cats is inevitable

Who are the players?

- *Microsporum canis*
- *Trichophyton mentagrophytes*
- *M. gypseum*

Of these three pathogens, *M. canis* is by far the greatest concern in a shelter or other population. The latter two – although a legitimate problem requiring diagnosis and treatment - are much less readily spread animal to animal, nor do they have as great a zoonotic potential. Skill and success in diagnosis and treatment of *M. canis* is most important in order to protect feline and canine populations and the people who are exposed to them.

What pre-disposes to ringworm?

Many factors common to shelters, foster homes and catteries predispose to development of dermatophytosis. Not only are these animals more vulnerable, they are likely to be less successful at overcoming infection without the support of effective topical and systemic treatment. Predisposing factors include:

- Species: cats are at much higher risk than dogs
- Age: kittens are at much higher risk

- Compromised skin
 - Trauma, allergies, parasites, matting
 - Allows dermatophytes to more easily establish an infection
 - Remember the possibility of super-infection of any skin lesion with ringworm
- Poor grooming habits
 - Grooming provides an important defense against ringworm, especially in cats
 - Long hair, stress, matted hair coat, URI, e-collar will all compromise the ability to remove stray spores by grooming
- Compromised immune system
 - Some of the most common causes of immune compromise in a group cat environment include pregnancy, FeLV or FIV infection, and treatment with steroids
 - Extra care should be taken to protect immunocompromised cats from exposure to ringworm
- High risk environment
 - Any cat from a shelter, foster home, cattery, pet store, or with recent exposure to a boarding kennel should be considered high risk

What can ringworm infection look like?

Ringworm can not be diagnosed by clinical appearance alone. The classic presentation is a circular area of hair loss and scaling. The most common locations include the face, pinnae, feet and tail. However, ringworm can present with a wide range of appearances, including military dermatitis or large areas of hair loss with or without crusts and exudate. Ringworm can infect the toe nails and nail beds. Ringworm may either resemble or secondarily infect conditions such as "stud tail", "chin acne", indolent lip ulcers and eosinophilic plaques. Lesions may or may not be pruritic. Any skin lesion in a high risk cat should be examined with a Wood's lamp, followed by a fungal culture in order to definitely rule ringworm in or out.

Wood's lamp

Although not a perfect diagnostic test due to the relatively high frequency of false negative results, a Wood's lamp - correctly used - can be a helpful and cost effective screening tool. It has been estimated that somewhere between 30-80% of *M. canis* strains will fluoresce; the actual frequency in ringworm-infected cats has not been documented but may be higher than the 50% commonly quoted. Bright apple green fluorescence coating the hair shafts is strongly suggestive of infection and warrants isolation and fungal culture. A negative Wood's lamp exam does not, of course, rule out infection and suspicious lesions should always be cultured. Some drugs and other products, notably tetracycline drugs and ointments, will also fluoresce. Fluorescence induced by dermatophyte infection can be distinguished as it will not easily be rinsed off. Observation of known lesions will help develop proficiency in recognizing true fluorescence. In order to maximize the usefulness of this test, it is important to use the right equipment, correctly:

- A true Wood's lamp should be used, as opposed to a generic UV light. Woods lamp's fluoresce at a particular wave length (360 nm).

- A plug-in, rather than battery model, is ideal as the stronger light is more likely to generate fluorescence.
- Perform the exam in a completely dark room.
- Allow the light to warm up for 5-10 minutes, and hold the lamp over the suspect areas for at least 5 minutes, as some strains take time to fluoresce.

Fungal culture

Ultimately the only truly reliable way to diagnose ringworm is via fungal culture. Performance of this test in-house, as opposed to sending it out to a diagnostic laboratory, has several advantages. In order to properly manage an outbreak of ringworm affecting multiple cats, numerous cultures are required: for risk assessment in exposed cats, diagnosis of suspect lesions and confirmation of cure after treatment. This can quickly become a prohibitive expense if cultures are not done in a cost effective way. In-house cultures can be done at reasonable cost while remaining profitable for the clinic, providing a valuable service for the client shelter, rescue group or cattery. Reading cultures in-house also permits a speedier diagnosis in positive cases – growth often occurs within a week, allowing earlier initiation of treatment. The amount of growth on a culture plate can help differentiate possible carriers from truly infected cats. Shelter personnel or cat owners can be instructed in the proper technique for toothbrush culture collection, and can simply bring samples in for ongoing monitoring purposes rather than bringing in all the infected cats each time.

Fungal culture collection technique:

- ✓ Wipe cat with damp cloth to remove coat contaminants.
- ✓ Use a fresh toothbrush in its package.
 - Toothbrush culture always for exposed cats with no visible lesions.
 - Toothbrush culture can also be used to collect samples from suspicious lesions. Alternately, if no clean toothbrush is available, hemostats or forceps may be used to pluck a sufficient quantity of hair from the suspect areas.
- ✓ At least 30 strokes:
 - Especially face, inside pinnae, around nail beds, lesions
- ✓ Swiffer™ for environment.
 - Cut into small sections, wipe possibly contaminated surfaces until visibly dirty
- ✓ Individual labeled baggies if multiple samples.
- ✓ Avoid heat exposure during transport (leaving samples in a hot car for twenty minutes could be enough to kill spores and lead to a false negative culture result).

Fungal culture details

- ✓ Room temperature dermatophyte test medium (the stuff that turns red with growth of most pathogenic dermatophytes); combo plates with Saboraud's agar or Rapid Sporulating Media are available and may assist with microscopic identification.
 - Plate style culture media is preferred over jars (decreased likelihood of contaminants, easier to take a tape sample for microscopic exam).
 - There is no such thing as a culture media that gives reliable results in less than ten days.

- ✓ Press toothbrush firmly into the culture, but not so much that culture is disrupted
 - Press Swiffer™ firmly numerous times
- ✓ Incubate at 75°- 85° F in the dark with a humidity source (A lightbulb can be used to create a makeshift incubator. Place a tray of water in the incubator to maintain humidity.)
- ✓ Examine daily until growth or for 21 days
 - Most *M. canis* will grow within 10 days in untreated cats – tentative negative at that point. Trichophyton tends to take longer to grow, but is not as great an *infectious* threat. Growth often takes longer once a cat is on treatment.

Identification

Not all dermatophytes turn the dermatophyte test medium red, so false negatives are possible. Some other types of non-pathogenic fungi can cause the red color, so false positives are possible too. To be certain of a diagnosis of ringworm, it is imperative to microscopically examine and positively identify the fungus. This is accomplished by microscopic examination of a “tape prep”:

1. Place a drop of lactophenol blue stain on a slide
2. Dab the sticky side of a piece of tape on the suspect colony
3. Place the tape over the drop of stain and examine under the microscope

Most culture media kits come with a guide to microscopic identification. Descriptions and photos for fungal identification can be found in Muller and Kirk's Small Animal Dermatology, 6th Edition, page 122 (Saunders).

Risk assessment for exposed cats

When any cat from a population is diagnosed with ringworm, the question arises: what do you do about the other cats in the environment? Do they all need to be cultured? Must they all be isolated while awaiting culture results? Will they all need treatment? The answer to these questions is dependent on several factors. Not all cats in the same house or even the same room as a ringworm-infected cat will become infected themselves. The risk of infection depends on the cat's individual immune status and grooming habits, the overall cleanliness of the environment, and the level of proximity between the exposed and infected cats. Some questions to ask include:

- **What is the baseline sanitation level?** Is this a highly cleanable environment such as a bank of stainless steel cages in an otherwise empty room? Is this a home with lots of scratching posts, furniture and carpeting to collect spores? Somewhere in between, such as a bank of cages in a messy room, with lots of junk piled about? Is bleach used on a routine basis for cleaning?
- **How closely exposed were the cats?** Were they each in separate cages, with minimal handling by staff likely to be carrying infection on their clothing? Was there some shared space such as an exercise area or “get acquainted room” where the cats co-mingle or spend time without cleaning between occupants? Are cats allowed to wander loose during cleaning but caged separately otherwise?
- **Is there evidence of spread?** Has more than one cat been affected? Are all affected cats from one area of the shelter, or has it shown up in more than one room? Are cats that have been in the shelter long term (> 2-4 weeks) affected? (This suggests

acquisition of infection in the shelter, as opposed to coming in already infected.)

If the environment is basically clean, cats are generally kept reasonably separated, and overall cat health is good, it is not uncommon for cats to survive a minor exposure without becoming infected. Ideally, all exposed cats will be toothbrush-cultured, but this is often impractical and may not be necessary in a reasonably well-run shelter. On the other hand, toothbrush cultures all around are generally required in a foster home where there are extensive opportunities for contact, in a cage-free cat shelter or group cat room, or any time there is evidence of significant spread (multiple cats affected).

Pathogen score: a tool for interpretation of toothbrush cultures in exposed cats

Not all cats that are positive on ringworm culture are truly infected – some may simply be functioning as “dust mops” that have picked up some stray spores from a contaminated environment. Obviously, a lesion plus a positive culture indicates true infection. However, for those cats that have no visible lesions, the amount of growth on a ringworm culture plate can give an indication of whether a cat is likely to require treatment or is simply a mechanical carrier. A pathogen scoring system (“P-score”) was devised based on monitoring of cats entering a shelter over a period of several years. Cats with a low pathogen score and no lesions upon very careful Wood’s Lamp exam may not require full treatment, and sometimes may be released for adoption after a reculture and single lime sulfur dip. More details on use of the P-score are available at:

<http://giveshelter.org/resources/dermatophyte.php>

Treatment of ringworm infection in multiple cat populations

Although many treatments are reportedly effective for individual cats, the frequency of self-cure makes these claims somewhat difficult to assess in the absence of supporting scientific evidence. In a population, treatment failure is more evident and common, and the requirements for highly effective treatment are rigorous. *The most important component of treatment in a population is topical therapy.* This is critical in order to reduce immediate and ongoing environmental contamination. Of all available topical therapies, lime sulfur dip is cost effective, relatively easy to apply rapidly to a number of cats, and has been documented to work in a shelter setting. Some currently available topical treatments are ineffective or only partially effective; use caution if selecting another treatment besides lime sulfur dip. *Chlorhexidine shampoos and locally applied topical ointments are not effective.*

Lime sulfur details:

- Use 8% concentration
- Apply twice weekly throughout treatment
- Okay in pregnant and nursing cats, kittens > 2-3 weeks old
 - Wipe nursing moms, keep kittens warm
- E-collar afterward may not be necessary

Lime sulfur application

- Do not pre-wet
- Consider using a pesticide sprayer for application:
 - Add powder first, then water
 - Keep close to cat
- Sponge dip on face, nose and ears

Systemic treatment

Systemic treatment is an important adjunct to topical therapy, especially in a shelter where time-to-cure is an important consideration. Extended stays in a shelter or foster care increase the chance of spread, use precious isolation space, and may reduce the adoptability of the patient, especially if kittens are allowed to grow old in treatment. The drawbacks of systemic treatment are the relatively high cost of the drugs and the possibility of toxic side effects. Itraconazole (5-10 mg/kg PO SID) is a good choice due to its demonstrated efficacy, relative safety, and long half-life in the skin. Fluconazole (10 mg/kg PO SID) and terbinafine (30-40 mg/kg PO SID) are also reportedly effective. Griseofulvin is effective, but more likely than itraconazole to cause toxic side effects, and is becoming increasingly difficult to obtain. Ketoconazole should be avoided in cats if possible, as it is relatively likely to cause hepatotoxicity in this species. Lufenuron (Program™) has been shown in repeated studies to be ineffective.

Animals on any systemic anti-fungal should be closely monitored, and all directions for administering the drugs carefully followed. These drugs should be avoided in pregnant animals. Compounding may be necessary to allow administration of sufficiently small doses for kittens. Alternatively, capsules can be divided manually into smaller doses, using gel caps, meatballs or butter.

To clip or not to clip?

Clipping is often un-necessary in short and medium haired cats, and may worsen lesions through microtrauma and mechanical spread of spores. However, clipping is indicated for seriously long haired cats and those that may be unable to groom due to conformation (e.g. Persians), concurrent severe upper respiratory congestion, or matted coat. Clipping may also be useful in cats whose coats simply become un-manageable after dipping. Clipping should be performed gently with a #10 blade – taking great care to avoid clipper burn - and hair should be carefully disposed of afterward. Clipping with a closer blade causes excessive trauma and increases the chance of worsening lesions. Clipping should be performed in a room that is easily cleaned since it causes heavy environmental contamination, and instruments used should be carefully cleaned and dedicated only to that purpose.

Verifying cure

With effective topical and systemic treatment, fungal cure may occur prior to clinical cure. Conversely, un-treated or ineffectively treated cats may appear cured several weeks prior to fungal cure – that is, they look all better, but are still contagious to people and other animals. For this reason, it is crucial to verify cure by consecutive negative fungal cultures. Three consecutive negative cultures, one week apart, are

generally recommended. Fungal cultures should be initiated starting at week one of treatment

Infection control during treatment

Obviously, infection control during treatment is of utmost importance in a shelter or rescue setting. The risk of spread is significantly reduced as long as effective topical treatment (lime sulfur dip) is initiated and maintained. It is a good idea to dip suspect cats even before diagnostic culture results are obtained. Cats need to be housed well away from vulnerable populations, ideally in an area with separate air supply, or at least where drift of infected hair can be controlled. Standard isolation precautions should be followed including protective clothing, limited personnel access, and separate supplies. Bedding should be discarded or washed daily with hot water and bleach, and dried in a dryer. Separate laundry facilities are not generally required, but care should be taken not to leave laundry laying around to get mixed in with general supplies. In a private home, cats should be kept in an easily cleaned environment such as a bathroom or large dog crate until at least 2 weeks of effective systemic and topical treatment have been completed.

What kills ringworm?

The short answer is, *not much* that is safe to use around people and cats! Options include:

- Bleach diluted at 1:10 (1.5 cups per gallon)
 - Applied to a clean surface
 - At least two applications, allowing the surface to dry between applications
- High heat (> 110° F)
 - Commercial steam cleaner
 - Commercial dish washer
 - Dryer
 - Hot car
- Dry environment and sunlight helps

What *doesn't* kill ringworm?

Equally important to know, many of the products commonly used in veterinary clinics and shelters – and even some labeled as effective against ringworm – have been shown NOT to work in independent trials. Ineffective or unreliable products include:

- Chlorhexidine
- Quaternary ammonium compounds
- Potassium peroxydisulfate (Trifectant™, Virkon-S™)
- Povidone-iodine
- Time: ringworm can persist for months and years if not mechanically removed or killed with an effective disinfectant, especially in a dark, moist environment.

Environmental cure: 5 D's

Environmental decontamination is usually straightforward in a typical shelter with easily bleached and mechanically cleaned cages. It can present a much greater problem in a home or more home-like group cat room. Application of harsh disinfectants to every contaminated surface is an impossible goal in a home environment. Fortunately, much can be accomplished through identification, removal and treatment of carrier cats,

followed by repeated application of elbow grease. Remember a great service you can offer clients with possibly contaminated homes is repeated environmental cultures. Have them try careful cleaning, followed by cultures of likely contaminated areas. If the culture is negative, they can feel reasonably comfortable opening their home to new cats. If positive, they know they have to go back and try again. This can save a lot of agony over whether to replace carpets, furniture etc. The five D's of ringworm decontamination are:

- Diagnose
 - Recognize and treat infected and carrier cats. No amount of cleaning or disinfection will work if one or more cats are re-contaminating the environment.
- Discard
 - Heavily exposed items such as scratching posts that can not be easily washed or bleached should be discarded.
- Debulk
 - Careful mechanical cleaning goes a long way towards removing ringworm contamination. This includes clearing cluttered surfaces, use of an electrostatic cleaning product such as a Swiffer™ to remove as much dust and hair as possible from every surface, and vacuuming of all accessible areas. Commercial steam cleaning of carpets may be helpful for both mechanical cleaning and heat destruction of spores. Where possible, furnace filters and air vents should be cleaned and/or replaced. However, cleaning of duct work is often not necessary.
- Disinfect
 - Apply bleach at 1.5 cups per gallon to all bleachable surfaces
- Document
 - Environmental culture

Repeat the five D's as necessary until environmental cultures are negative!

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