Ringworm

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Ringworm in animal shelters can lead to almost unmanageable outbreaks, thousands of dollars in diagnostic and medical costs, the possibility of spread to adopters and staff, and an intolerable blow to shelter status in the community. It is vital to have a consistent and effective strategy to prevent and manage this disease. "Ringworm", or dermatophytosis, is a fungal infection affecting the skin, hair and occasionally nails of animals (and people). Three species of ringworm fungus most commonly affect cats and dogs. Microsporum canis,Trichophyton mentagrophytes and Microsporum gypseum.

Factors that increase risk of ringworm

- **Age**: Animals of any age are susceptible, but young animals (<1 yr old) & geriatric animals are at the highest risk.
- **Species and breed**: Cats are at greater risk than dogs. Persian cats and Yorkshire Terriers are at relatively high risk, as are long haired cats in general.
- **Immune status**: Conditions that compromise the immune system such as FIV, FeLV, pregnancy/lactation, malnutrition, or anti-inflammatory drugs, stress.
- **Preexisting Conditions**: Animals with preexisting conditions that compromise grooming (such as URI) or skin integrity (such as flea allergies, overgrooming, and external parasites), weaning kittens as queens are beginning to grooming them less are at increased risk.

Transmission

M. canis is most often spread from contact with an infected animal or a contaminated environment, and therefore is by far the most likely to be a serious problem in a shelter. Ringworm is very durable in the environment. Ringworm can persist in carriers, furniture, carpets, dust, heating vents, furnace filters and the like, and can infect animals housed in a contaminated environment months and even years later. Ringworm can be spread readily on grooming implements, contaminated toys and bedding, or by humans on clothing and hands. It can be found on the hair of animals from a contaminated environment even when the animal itself is not showing any signs. In nature, the incubation period for ringworm is between 4 days and 4 weeks.

Clinical appearance

The most common locations include the face, ears, feet and tail of cats. However, ringworm can present with a wide range of appearances, including large areas of hair loss with or without crusts and exudate. Ringworm can cause infection of the toe nails and nail beds. Ringworm may resemble or secondarily infect other conditions such as flea allergy dermatitis, "stud tail" and "chin acne" in cats. Especially consider ringworm as a possible cause of these conditions if the cat is known to have been recently exposed. Ringworm lesions may or may not be pruritic (itchy).

Diagnosis

Accurate diagnosis of ringworm is very important. Although there is no definitive way to confirm absence of fungus except by careful fungal culture and microscopic examination there are tools that, if used correctly, can greatly help in identifying suspect cases. These "tools" include using common sense and risk assessment. For example, a classic ring shaped lesion in a kitten, especially if multiple members of a litter are affected, is very likely to be ringworm.

Wood's lamp

The Woods lamp is an ultraviolet light with a specific wave length of light that causes some strains of *Microsporum canis* to fluoresce. Although not a perfect diagnostic test, a Wood's lamp – when correctly used - can be a very 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 rule out infection and suspicious lesions should always be cultured. Some drugs and other products, notably tetracycline drugs, KMR milk and ointments (e.g. terramycin), will also fluoresce. Fluorescence induced by dermatophyte infection can be distinguished from fluorescence due to contaminants by the fact that ringworm cannot be easily 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 lamps 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.
- Look the animal over carefully, especially on the face, feet, belly, and inside the ears

Although absence of Woods lamp fluorescence by no means rules out ringworm infection, a positive result is a good indicator to at least isolate the animal until fungal culture results can be determined.

Direct microscopic examination

Like the Woods lamp, positive findings in direct examination can diagnose ringworm, but negative findings do not rule it out. False negatives occur between 40% - 70% of the time. Results can be improved through practice. Hair may be suspended in mineral oil and examined directly. Some people recommend clearing the sample of keratin by suspending it in 10 - 20% KOH or chlorphenolac prior to examination. The slide is then allowed to stand for 30 minutes at room temperature. Infected hairs appear swollen, frayed, irregular or fuzzy in outline, and the normal structure of cuticle, cortex, and medulla is lost. Arthroconidia (beaded chains of small rounded cells) and hyphae can sometimes be seen. Hyphae are uniform in diameter, septate and variable in length and degree of branching. Dermatophytes do not form macroconidia in tissue, so any macroconidia seen represent other species of fungus.

Recognition of affected hairs takes practice. To get experience in making a diagnosis by this method, examine known infected hairs from a Woods lamp-positive lesion. Doubtful cases should be cultured.

Fungal culture

Ultimately the only truly reliable way to diagnose ringworm is via fungal culture. It is advantageous to perform this test in-house where possible, as opposed to sending it out to a diagnostic laboratory. 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. Reading cultures in-house also permits a speedier diagnosis in positive cases – growth often occurs within a week, allowing earlier initiation of treatment.

Allowing the cultures to incubate between 75-80 degrees Fahrenheit will speed up the identification of fungal growth. Plate style cultures are easier to inoculate via toothbrush than the little jars, and also easier to take samples from for microscopic examination. Plates that combine dermatophyte test medium on one side (to give a red color change with most species of dermatophytes) with rapid sporulating medium or Sabouraud's dextrose agar on the other side (to aid in microscopic identification of colonies) are ideal.

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).

Treatment

A comprehensive outline of ringworm treatments can be found on the Dane County Humane Society’s website at: http://www.giveshelter.org/ringworm-treatment-program.html.

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. Miconazole shampoo in combination with chlorhexidine may also be effective; chlorhexidine alone is not. Enilconazole dip, although reportedly effective, is not available for this use in the United States (it is regulated by the EPA rather than the FDA, which does not permit off-label use in the same way). Chlorhexidine shampoos and locally applied topical ointments are not effective.

Systemic treatment is an important adjunct to topical therapy, especially in a shelter where time-to-cure is an important consideration. The drawbacks of systemic treatment are the relatively high cost of the drugs and the possibility of toxic side effects. Itraconazole is a good choice due to its demonstrated efficacy, relative safety, and long half-life in the skin. Fluconazole and terbinafine 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.

Preventing ringworm

The adage “an ounce of prevention is worth a pound of cure” is especially applicable to ringworm. Although it may seem like the time invested in screening all incoming cats for ringworm is too high this process can be stream-lined and become an easy part of the intake

protocol. It is advised to inspect carefully all incoming animals and all animals being considered for foster care or group housing. By following these five steps at intake it may be possible to avoid ringworm outbreaks in shelters:

1. Look for any areas of hair loss, scabbing, or crusting, especially focal areas affecting the face, ears, feet or tail.
2. Perform Woods lamp examination of all suspicious lesions and all cats being considered for placement in group housing or foster care.
3. Use correct technique and do direct microscopic examination of hairs from suspicious lesions.
4. Fungal culture and microscopic identification in all cases where definitive diagnosis is required.
5. Segregate affected or suspected animals and institute cleaning protocols to prevent further spreading.

Environmental decontamination

The foundation of environmental decontamination is identification and treatment or removal of affected animals coupled with careful mechanical cleaning. Ringworm will be most persistent in a moist environment protected from exposure to sunlight, and can remain infective for months or even years. Do not dismiss the benefit of dust and clutter control. Efficacy of a number of cleaning agents against ringworm has been tested. Concentrated bleach has been shown to be effective in killing 100% of spores in a single application. Concentrated bleach is too harsh to be routinely used, so multiple applications of bleach diluted 1:10 with prolonged contact time are recommended. High heat (> 110 degrees) is also effective. This temperature can be attained by commercial dishwashers, some commercial steam applicators (but not necessarily home steam carpet cleaners) and clothes dryers. Quaternary ammonium compounds (i.e. parvo-sol®), chlorhexadine (Nolvasan®) and potassium peroxymonosulfate (Trifectant®, Virkon-S®) have not withstood independent trials to demonstrate efficacy. Recent in vitro studies have indicated that accelerated hydrogen peroxide is effective against ringworm (e.g. Virox®, Accel®). In vivo studies are now being conducted by *Karen* A. *Moriello*, DVM, DACVD University of Wisconsin–Madison.

Summary

- There is no effective vaccine.
- There is no absolutely reliable screening test but there are good tools that can minimize shelter outbreaks.
- Practice good husbandry: keep animals clean, well-nourished, treat other diseases and internal parasites, *avoid overcrowding and stress.*
- Avoid mixing kittens with adult cats.
- Perform careful visual exam of all incoming animals and isolate suspects. Conduct Woods Lamp testing on all suspect cats.
- Further screening of foster and group housing candidates as described
- Develop a clear written protocol for handling ringworm, and ensure that staff and foster care providers are familiar with this protocol and the signs of ringworm.