

## **Infection control practices for veterinary clinics adopting animals infected with or exposed to ringworm**

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### **Admission examination and testing**

All animals should be examined closely at admission, for general health status as well as the presence of skin lesions. Animals without skin lesions should be cultured for dermatophytes using the toothbrush culture method (see below). Wood's lamp should be used to determine whether there are any fluorescing dermatophytes (which will appear along the hair shafts as an apple-green colour). If fluorescing dermatophytes are present, that can facilitate sample selection for culturing and ongoing monitoring, but it is important to remember that not all dermatophytes will fluoresce. A single negative admission culture and negative Wood's lamp test does NOT guarantee that the animal is ringworm free.

### **Diagnostic testing**

#### *Wood's lamp (ultraviolet lamp) examination*

This is a reasonable screening test, but is NOT definitive. It detects fluorescent metabolites produced by some strains of *Microsporum canis* when growing in hair (not in scale). False fluorescence is commonly produced by scale and debris on the skin. Remember, the fluorescence must be green and along the hair shafts to be considered suspicious. Suspected fluorescing hairs should thus always be cultured to confirm presence of dermatophyte infection. The situation where a Wood's lamp is truly useful is monitoring infection status when a fluorescing strain is involved.

#### *Fungal culture*

The toothbrush technique is much preferred as it increases the surface area collected. It is especially valuable in "clinically normal" patients or post-treatment animals. A new toothbrush is vigorously combed over the lesions (or alternatively, all parts of the haircoat) for 2 to 3 minutes. Hairs should be visible in the bristles. The toothbrush should be placed in sealable plastic submission bag and sent to a diagnostic laboratory. In clinically affected pets, sample hair shafts from the periphery of the lesions using sterile forceps.

### **Housing**

Animals must be housed in an appropriate isolation room. Because of the highly transmissible nature of ringworm, housing infected animals in a general ward location with enhanced barrier precautions is discouraged.

Ideally, animals should be housed individually with no contact with other animals. If that is not possible, multiple animals can be housed in the same isolation room, however it is preferable that clinically infected animals and potentially infected but clinically normal animals be kept in separate locations. No other animals should be

housed in the isolation room(s) at the same time because of the risk of cross-transmission. Animals with clinical signs of ringworm should not be housed in contact with animals that are apparently healthy. If animals are kept in a group, all must be treated at the same time. Post-treatment testing, as described below, must be performed on all animals. None of the group of in-contact animals can be considered ringworm-free until every animal in the group is culture negative.

### **Management**

Cats should be kept in their cages or within a confined isolation area. They should not be allowed out for exercise or socialization until they are deemed to be ringworm-free. Dogs should only be taken outside to urinate and defecate. Ideally, even this should be avoided, particularly during the initial treatment period - if possible, dogs should stay inside and urinate and defecate in a run. When dogs are taken outside, they should use an exit that does not take them past other animals or people. Contact with other animals or people, in the clinic or outside, must be prevented. Dogs should be walked in an area that is not used by other animals. People walking the dog should wear protective outerwear that prevents contamination of their regular clinic clothing (including sleeves and pants) and wear gloves. Infected or potentially infected animals should be walked using rope leashes which should be disinfected every few days by autoclaving or soaking in 1:20-1:50 bleach solution or accelerated hydrogen peroxide for 10-30 minutes. Ideally, each animal or co-housed group will have its own leash to prevent cross-contamination. Collars should not be used, if possible. If collars are used, they should be disinfected periodically during the treatment period, and at the end of the treatment period. This can be done as per leashes.

### **Personal protective equipment/personal hygiene**

All persons having contact with the animals or their environment must wear protective outerwear (e.g. gown, labcoat) that is only used for handling those animals. Isolation gowns are single use and must not be reused. Lab coats can be re-used as long as it is possible to remove the lab coat and store it without contaminating the local environment. For large dogs housed in runs or those that must be taken outside, personnel must wear appropriate outerwear to prevent contamination of their pants when they are handling dogs on the floor. Reusable items must be laundered using hot water and hot air drying. Proper protocols for laundry handling must be in place to prevent exposure to personnel handling laundry.

Gloves should also be worn whenever there is contact with potentially infected animals or their environment. Gloves must be removed immediately thereafter and hands must be washed after glove removal. Care must be taken to prevent contamination of surfaces (e.g. pens, records, equipment) with gloved hands outside of the isolation room.

### **Treatment**

While ringworm is typically self-limiting, treatment is indicated when dealing with multiple animals in a situation like this.

*Exposed, culture negative, lesion free animals*

Topical therapy should be started at arrival to eliminate any surface spores that have contaminated but not infected the coat. This can consist of 2% lime sulfur dip, terbinafine spray, or enilconazole spray or dip. Enilconazole is only approved in dogs, and if used in cats, an E-collar must be placed on the cat to prevent ingestion because of the risk of hepatopathy. Animals should be treated twice a week.

*Exposed clinically normal, culture pending animals*

Oral terbinafine (30-40 mg/kg/d, dog or cat) or itraconazole (5-10 mg/kg/d, dog or cat) can be added to topical treatment (see above) to hasten culture negative status and reduce the risk of transmission. Clipping these patients is not necessary.

*Clinically normal, culture positive*

Oral terbinafine (30-40 mg/kg/d, dog or cat) or itraconazole (5-10 mg/kg/d, dog or cat) can be added to topical treatment (see above) to hasten culture negative status and reduce the risk of transmission. Clipping is not required in all cases, but should be considered on a case-by-case basis (i.e. long-haired cats).

*Exposed clinically affected, culture positive animals*

These patients should be clipped (see procedure below). At a minimum, affected sites must be clipped. Clipping of the entire body can be useful, particularly in long-haired cats. Oral terbinafine (30-40 mg/kg/d, dog or cat) or itraconazole (5-10 mg/kg/d, dog or cat) should be added to topical treatment (see above). All treatments should be continued until the animal is declared ringworm-free, as described below.

### **Clipping Hairs**

This is indicated in multiple-animal group housing household, for environmental control and to facilitate topical treatment. Clipping and proper removal of infected hairs can reduce subsequent environmental contamination. Care must be taken to avoid disseminating infected hairs during clipping. All in-contact personnel should use protective clothing (protective outerwear, gloves). Pets should be sedated and the majority of their body inserted into a garbage bag. The hairs should be clipped short and gently (but not very close like a presurgical clip – use a #10 clipper blade) into the garbage bag. Once clipping is complete, the patient and vicinity can be vacuumed if a vacuum equipped with a HEPA filter is available. The garbage and vacuum bags should be sealed and disposed of as biohazardous waste.

### **Post-treatment testing**

Toothbrush cultures should be performed during treatment to determine when treatment can stop. Standard recommendations have been to start culturing after approximately 4 weeks of treatment, however some have suggested that starting earlier may be useful. There is no downside to testing earlier except for the cost of cultures. Samples for culture should be taken before application of topical antifungals. Animals can only be declared ringworm-free with a minimum of 2 consecutive negative cultures taken biweekly to monthly after all potential contact with infected individuals is stopped. If co-housed, all animals must have 2 negative cultures before any of the group is declared ringworm-free.

## **Cleaning/disinfection**

Dermatophytes can survive in the environment for prolonged periods of time; up to 18 months in one study. Environmental cleaning and disinfection are important but difficult. Various disinfectants have been shown to be effective against dermatophytes, however this is based on *in vitro* testing on the mycelial form or microconidia, not infective arthrospores, and does not consider the effects on organic debris (skin, hair) with which dermatophytes are usually associated. There may, therefore, be poor correlation between *in vitro* and *in vivo* efficacy. Bleach (1:10 – 1:100 dilution of household bleach) is used commonly as it is readily available and cost-effective. However, bleach is noxious and not appropriate for many surfaces such as carpets. Other disinfectants such as accelerated stabilized hydrogen peroxide or peroxygen disinfectants have been recommended by some, however efficacy data are sparse. Regardless of the disinfectant used, a minimum contact time of 10 minutes is required, with some disinfectants requiring longer. An additional approach is the use of 0.2% enilconazole spray. Because of the difficulty with disinfection, comprehensive environmental disinfection is not probably indicated throughout the treatment period, particularly if there is no evidence of ongoing transmission. Thorough decontamination should be performed after the animals have been removed from isolation.

Removal of debris is critical, yet there is limited information about how to do so effectively and safely. Vacuuming areas where infected animals have been can remove infective particles, yet the use of vacuums without HEPA filters could simply disseminate dermatophytes throughout the environment. Steam cleaning is a potentially viable alternative, as moistening of infective particles would presumably reduce the risk of dissemination. Aerosolized accelerated hydrogen peroxide is another option. High-pressure power washing should be avoided because of the potential for dissemination of dermatophytes through aerosolization. Consideration must be given to other surfaces and objects with which infected animals may have had contact. Animals' bedding, toys, cages and other items should be cleaned and disinfected. Cleaning followed by chemical disinfection and washing in hot water followed by hot air drying are potential options. Items that cannot be adequately decontaminated should be discarded, if possible. Replacement of furnace/registar filters and use of HEPA filters during the treatment and decontamination period may help reduce airborne dissemination, but the feasibility and necessity of this depend on the individual ventilation system.

More information about ringworm control and zoonotic disease concerns can be found at <http://www.wormsandgermsblog.com> in the Resources section.