

How Animal Shelters Are Beating Ringworm (And Yours Can, Too!)




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Acknowledgements

It all started with a pink trailer....



Dane County Humane Society, Dane County Wisconsin
Dermatophyte Treatment Program Annex Facility

...and Dr. Sandra Newbury* of UC, Davis who was the DCHS shelter veterinarian whose vision and dedication to shelter medicine field research proved "ringworm is a treatable and curable disease in shelters"

*Current address: Sandra Newbury, DVM, National Shelter Medicine Extension Veterinarian, Koret Shelter Medicine Program, Center for Companion Animal Health, U C Davis School of Veterinary Medicine

Everyone Knows Someone With "Ringworm"




Trichophyton infections in people, this is not from the cat!

So what is the fuss all about?

- Skin diseases are common in shelters....
 - No evidence that the primary pathogen of importance (*Microsporum canis*) alters its pathogenicity unlike other infectious agents (e.g. viral infections)
 - Contagious and easily transmitted
 - BUT is non-life threatening
 - Skin lesions almost never cause any long term damage
 - Treatable and curable
 - Good prognosis
 - Has features similar to many other skin diseases such as *Cheyletiella*, *Sarcoptes*, *Otodectes*, fleas, and ticks

Again, Why SO Important?

- The primary reason dermatophytosis is of importance in shelters is that it is a disease of **public health concern**
- Routine intake procedures (e.g. vaccination, application of flea control) do not protect the population from disease, unless a screening protocol is in place
- Affects the most adoptable population in a shelter (i.e. kittens and puppies)
- This is a highly charged topic with respect to management
- (And a possible PR nightmare)



How common is it really?

- *Microsporum canis* is the primary pathogen of concern in shelters
- Highly variable: geographic region, population density, husbandry practices, intake procedures, etc.
- Reports of 4 to 100% but numbers can be misleading depending upon whether the study reports prevalence based solely upon positive culture status or makes correlates cats that are truly infected (lesions, Wood's lamp positive, culture positive)
- **"Culture positive" simply means infective spores were found on the hair coat, it does not necessarily mean the cat is infected**

Transmission



How Lesions Develop

- Cat to cat transmission is the most common mode
- Spores must make contact with the skin
- Spores must adhere to the skin and defeat skin/cat defense mechanisms
- Successful infection also requires micro trauma that compromises the epidermal skin barrier
- Incubation from contact and germination to obvious clinical lesions is approximately 14 to 21 days
- Can only in skin



Field Study On Risk Factors

- 8256 fungal culture from various shelter cats
 - 628 were culture positive
- Looked at age, sex, hair length, presence of lesions, source (surrender vs. stray)
- What was SIGNIFICANT for culture positive status?
 - Age (1.3 x more likely in kitten/juvenile vs. adult)
 - Hair length (1.3 x more likely in medium and long haired cats compared to short hair)
 - Lesions (2.4 x more likely to be culture positive than non lesional cats)

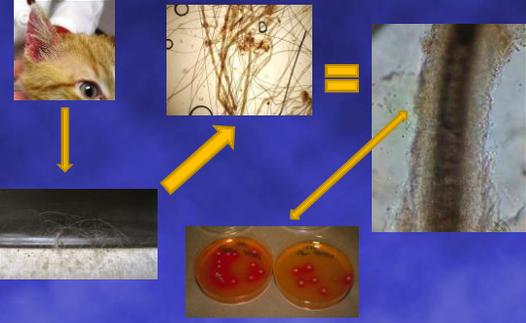
What Aides Transmission, Adherence and Ultimately Infection?

- Cats that cannot groom for **any** reason
- Skin trauma from bites, scratches, ectoparasites
- Matted hair coats
- Maceration of skin from high humidity from dampness post cleaning
- Cats in poor body condition from debilitating and/or concurrent diseases
- Age extremes-the very young, the very old
- STRESS



All of these can transmit infective spores or be a trigger for skin trauma

Environmental Contamination



What is the known risk?

- Major problem with environmental contamination is confounding culture results
- Toothbrush cultures cannot distinguish between fomite carriers and truly infected cats



What About Infection and Spores in Environment?

- Fomite transmission that leads to infection is hard to document

Wiley-Blackwell
E-Print and Reprint solutions

Microsporium canis infection in a 5-year-old boy: transmission from the interior of a second-hand car
 Microsporium canis-Infektion eines fünfjährigen Jungen: Übertragung durch die Innenrichtung eines Gebrauchtwagens
 P. Thomas, H. C. Koning, W. Strauß, T. Ruzicka

Issue
 Mycoses
 Volume 37, Issue 3-4, pages 141-142, March 1994

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 DOI: 10.1111/j.1439-0507.1994.tb00791.x

FACTS AND MYTHS ABOUT SPORES IN THE ENVIRONMENT

Fungal spores can only grow and multiply when they successfully contact the skin surface, germinate and invade skin and hairs..... They are like M&M's, what ever falls out of the bag (or off the cat!) is all you have....Again, they do not multiply,



FUNGAL SPORES ARE NOT LIKE MOLD, THEY DO NOT GROW , INVADE AND SPREAD IN THE ENVIRONMENT

FACTS AND MYTHS ABOUT SPORES IN THE ENVIRONMENT

FUNGAL SPORES AND THE FURNACE*

Do forced air heating systems spread spores? Field study:
 Culture plates were placed over forced air heating vents in a facility housing cats under treatment. Plates were always culture negative. **HOWEVER** the furnace filter was always culture positive!




Furnace filters trap infective spores, get the best filters you can afford and change them monthly or sooner if full of cat hair and dirt. Money well spent!

*These studies were funded by an unrestricted gift from Maddie's Fund

Studies On Cleaning and Disinfectants*

Disinfectant Efficacy of Accelerated Hydrogen Peroxide Against *Trichophyton spp.*, *Microsporium gypseum* and *Microsporium canis*

Hindra B. Kunder D. Morfelle M.
 Parasitology Biology 152, School of Veterinary Medicine, University of Wisconsin, Madison, WI 53706

Efficacy of eight commercial disinfectants against *Microsporium canis* spores on contaminated textile swatches

D. A. Kunder, K. A. Morfelle
 Department of Medical Sciences, School of Veterinary Medicine, University of Wisconsin, Madison, WI 53706

One-year Surveillance of the Isolation of Dermatophyte Spores from Risk Areas in a Veterinary Medical Teaching Hospital

W. K. SODERSTROM, K. N. MORFELLE
 Department of Medical Sciences, School of Veterinary Medicine, University of Wisconsin, Madison, WI 53706

*In Progress: Decontamination of Textiles-Winn Foundation
 In Progress: Decontamination of Pet and Foster Homes After Exposure to an Infected Cat**

*These studies were funded by an unrestricted gift from Maddie's Fund

What is the EVIDENCE to date

- Environmental control for ringworm needs to be constant and continual
- If it is all you can do, it is a lot!
- **Two most important steps**
 - Aggressive mechanical removal of hair and debris
 - Aggressive scrubbing with a detergent and rinse clean water




#1: CLUTTER BUST AND SIMPLIFY



#2: Sweep and Wash, and WASH AGAIN

- There is no "magic" disinfectant (including bleach!)
- Any cat safe disinfectant fails if the area is not properly prepared
- **Spores are protected from contact with disinfectants by dirt, debris and the hair shaft**
- **AGGRESSIVE** good old fashioned cleaning and washing with a detergent is the most valuable step in decontamination
- Must rinse the area with clean water and allow it to dry BEFORE applying a disinfectant

GET STAFF FRIENDLY CLEANING TOOLS



3M Easy Trap Duster
Like a "Post a Note" Swiffer!



3M Easy Scrub Flat Mop Tool
Re-usable and easily cleaned!



#3: Apply A Disinfectant

- Carefully read the label and look for products tested against *Trichophyton mentagrophytes*
 - *In vitro* studies found many over the counter products for controlling this pathogen killed *M. canis* when used properly
 - *In vivo* field studies still need to be performed
- Snuck in the label of "one step "products are comments to "grossly remove debris before use"...
- Thoroughly soak area and keep it wet for the time on the label (5-10 min)

Clinical Signs

- Skin lesions tend to start on thinly haired areas where spores can contact skin
- Skin lesions are often found in areas where there has been micro trauma
- Clinical signs directly reflect how the disease is transmitted and the normal pathogenesis



Kittens-lesions often start on face



Subtle Lesions



Ears, Ears, Ears.....



Rex Cats and Severe Dermatophytosis



Odd and/or Dramatic Lesions



Long haired cat issues

Reservoirs near eyes



MECHANICAL CARRIERS or TRULY INFECTED???

“It’s ringworm until proven other wise.”

OH, NO IT’S NOT!!

Real World Field Study

- Open admission shelter with screening program on intake:
 - Culture data from 5644 cats over 24 months
 - 584 culture positive cats (10.3%)
 - 381 of 5644 cats had skin lesions (6.75%)
 - Only 94 of 5644 cats were both lesional and culture positive and found to be infected (1.6%)
 - 490 cultures positive cats were found to be fomite carriers,
- Note: Only 1 in 4 cats with skin lesions had dermatophytosis
- And only 1.6% of cats had ringworm, not 10.3%

Beating Ringworm: You need to screen. Why is screening so important?

- Public safety
- Outbreak prevention
- Foster homes
- Life and death decisions
- Because there is no other way to know



Diagnostic Tools

- Physical Examination**
 - Skin lesions may be felt before seen
 - Examine in good lighting
 - Consider using a flashlight as a strong beam may identify lesions otherwise missed
- Wood's lamp**
- Direct Examination of Hairs**
- Fungal Culture

**On site, cost effective, time effective screening tools

Wood's Lamps-Eating Crow?

- Comment that 50% of clinical specimens glow has been repeated over and over in the literature
- Comment appears to stem from human medicine where human hygiene practices greatly influence Wood's lamp examinations
- **Experience from shelter cats (Another Field Study!)**
 - Fomite carrier cats do not glow
 - Infected untreated cats with true ringworm lesions- very very commonly **GLOW**

Wood's Lamp: Your friend



Subtle lesion missed on physical exam but found with a Wood's Lamp

- Areas with skin lesions are most likely to glow, it can take several minutes for glowing to be obvious, be patient
- **POSITIVE hairs glow bright green**
- Dust and dander glow white or blue-white are **NEGATIVE**
- Medications and oils on the hair coat can glow yellow, orange, etc, these are **Negative**
- Carpet fibers can also glow, some even apple green-you can easily tell a carpet fiber from a cat hair

Pictures courtesy of A. Canupp

Glowing Hairs

- Pluck hairs in direction of growth so they do not break, place in mineral oil and coverslip prior to examination



Glowing is caused by a metabolite that is produced when cat ringworm grows on hairs

The glowing can be affected by lots of things, including bathing

Cannot always find glowing hairs on infected cats

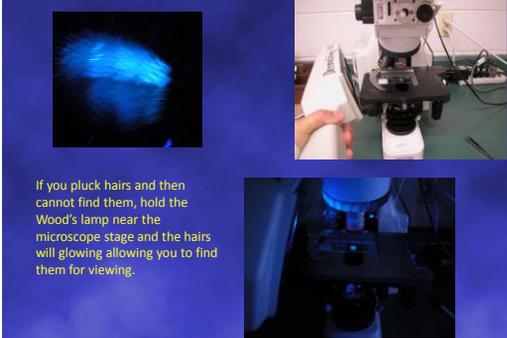
Direct Examination of Hairs: Not a mystery



This test is only helpful if Wood's positive hairs are examined. Infected hairs (arrow) are pale, wider and easily visible when compared to normal hairs. The image at the left shows a close up. The hair is cuffed with infective spores.

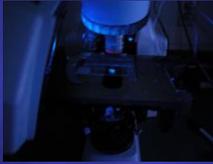


Wood's Lamp Use In Laboratory



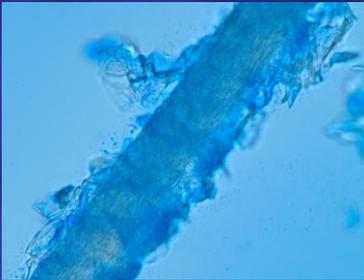
If you pluck hairs and then cannot find them, hold the Wood's lamp near the microscope stage and the hairs will glowing allowing you to find them for viewing.

Wood's Lamp Use In Laboratory



A positive direct examination is confirmation of infection. Treatment can be started while fungal culture is pending. This information can be available on Day 1 of admission. This is an important and powerful aid in management of ringworm in shelters.

Direct Examination



Adding new methylene blue to mineral oil can be helpful. Here the infected hair absorbs the stain. Normal hairs will not.

Getting the Toothbrush Culture Right

- Use a new toothbrush and comb the entire cat's body for 20 strokes and/or until there are hairs in the bristles
- **If the cat has lesions, culture all other areas first**
- Pay special attention to face, bell of the ear, eyes, digits



Note: Individually wrapped toothbrushes are sterile. Toothbrushes can be bought in bulk on line from hospitality supply stores

If the samples are not going to be set up immediately, wrap the head of the toothbrush in an inexpensive plastic sandwich bag. (DO NOT KNOT. It is important to be able to easily remove the bag from the head of the toothbrush.) This protects the person taking the sample out of the bag from ringworm spores.




Place wrapped toothbrush into a plastic bag. Double wrapping protects against accidental human infection. The person setting up the samples can remove it without exposure. Place ID information ON THE BAG or on slip inside.

THIS IS WRONG!

1. The toothbrush head is not wrapped exposing the person opening the bag to spores
2. The person taking the specimen out of the bag is using bare hands.
3. The combination of bare hands and an unwrapped toothbrush can lead to human infections and spread of spores!
4. This can result in cross contamination.



In House Fungal Cultures: Yes you can!



- Always set up cultures in a clean area
- Hold culture plates with medium side up
- Gently stab the tips of the toothbrush into the media.
- If the tips are yellow, you have done it right.
- Cover the whole plate in a consistent pattern.
- Use Chlorox wipes as a drop cloth to prevent contamination of area



WRONG!



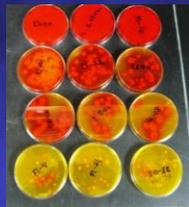
Inoculating plates with fungal culture surface UP can cause the following problems:

- *False positive cultures due to spores falling on plate
- *Spreading of spores into the air while stabbing the plate
- *Contamination of area

RED DOES NOT MEAN POSITIVE



Need to inoculate with glowing hair



RESULTS

- Positive
- Negative

NOTE: The color change occurs 24-72 hours after the medium is inoculated.



Dermatophyte Test Medium

- Look for pale or white colony with a red ring of color developing around it as it grows
- Ignore any colony with NO red ring of color developing it as it grows
- Ignore ANY COLONY that is heavily pigmented
- YES IT IS THAT SIMPLE TO IDENTIFY THE COLONIES THAT MUST BE SAMPLED

Where is the suspect pathogen?



What to BUY?

- It's not the type of medium that matters most, it's the temperature of incubation that matters most (not room temperature! >70° or higher)
- You want the most medium volume per dollar you can get
- Can also purchase petridish plates from sources



Dual Plates? Why?



Must Confirm via Cytology: Look for the CANOES!!



What is the "P" Scoring System?

- Simply getting a "positive" or "negative" for *Microsporum canis* is not satisfactory for making informed decisions in shelters
- "P" score or "Pathogen score" refers to the number of colony forming units growing on a plate and is used in decision making for treatment and for monitoring response to treatment.*
- This is a useful tool to communicate accurately fungal culture results to staff involved care of ringworm cats.
- It can also be used to help monitor environmental decontamination

*This is explained in detail in chapter on Dermatophytosis in *Infectious Diseases of the Dog and Cat* (Greene CE, 2012) and in the Dermatophytosis chapter in *Infectious Disease Management in Animal Shelters* (Miller L, Hurley K 2009)



Colony counts: Colony forming units (CFUs) - done on all plates

Examples

- P1 or P2 cat
 - No lesions on repeat examination and Wood's lamp examination-fomite carrier, prophylactic topical treatment and "go"
 - Lesions on repeat examination and Wood's lamp examination-truly infected, culture was obtained early in the infection: TREAT CAT
- P3 Cat
 - >10 colonies often too many to count
 - Could be truly infected or fomite carrier exposed to contaminated environment, TREAT CAT

Summary of General Clinical Presentations

- Simple infected group
 - Otherwise healthy cats or kittens with confirmed lesions, lesions limited in extent, if otherwise healthy these cats will respond well to therapy
- Complicated infection group
 - Widespread lesions, inflammatory lesions, long hair/matted hair other illnesses (ie. URI), history of prior treatment, surrendered for resistant "ringworm", semi-feral/feral cats. These cats are complicated to treat because antifungal therapy must be coordinated with treatment for other pre-existing diseases
- Lesion free but culture positive
 - Consists of cats that may be mechanically carrying spores on the hair coat (dust mops) or cats with early lesions that are not seen but mature enough to be spreading spores. Colony forming units on culture, examination and Wood's lamp examination will help differentiate fomite carriers from early infection

Shelter Treatments

- Effective topical applied twice weekly
 - Lime sulfur
 - Enilconazole
- Systemic Antifungal
 - Itraconazole
 - 21 day course
 - Daily course
 - Week on/Week off
 - Terbinafine (recommendation based upon field study)
 - 21 day course

If you can only afford one treatment...



...go for the wet and smelly.

Slide Courtesy of Dr. Newbury, UC Davis Shelter Medicine Program

Dilution and Mixing

- 1:16 dilution
- 8 oz of water and 120 oz of water
- Mix by putting 8 oz. of lime sulfur in EMPTY GALLON , then fill to 1 gallon
- Warm water
- Mix fresh solution each time, discard excess



Confusing Lime Sulfur %

- Materials Safety Data Sheet
 - Lime Sulfur Solution: Commercial Use
 - Calcium polysulfide 29%
- Materials Safety Data Sheet
 - Lime Sulfur Solution: Veterinary
 - 97.8% Lime sulfur
- Identical products
 - Look different due to labeling
 - Both diluted the same



Garden Sprayers

- Half gallon sprayer is preferred.
- Easily lifted when full.
- Solution stays warm.
- Short stubby spray nozzle helps with control.
- Clean thoroughly after each use.
- Fill with hot water and allow to discharge completely to prevent clogging of nozzle and valve.



Treatment Failures? Get Eyes On It



Treatment Failures

- Improper mixing of topical antifungal rinse, shake bottle before using!
- Wetting cats prior to applying rinse, makes it harder for liquid to “cling” to hair coat
- Matted hair coat that must be clipped
- Poor application technique-often face is missed
- Using compounded itraconazole
- Cat has underlying medical problem
- Environmental contamination causing false positives
- In group housing, unrecognized infected cat

Treatment Monitoring

- Cats will clinically cure before they are fungal culture negative
- Two negative cultures at weekly intervals
- **Weekly fungal cultures ARE less expensive**
 - Cost per fungal culture is less than or equal to one animal care day
 - Weekly cultures will identify cats faster, often 2-4 weeks sooner than by starting cultures at 4 weeks
 - Weekly fungal cultures will decrease the time cats are in confinement, decrease the number of dips they need to receive, and decrease personnel costs.
 - Will identify cats that are fomite carriers as they will rapidly become culture negative
 - Will identify cats that are not curing due to some treatment complication

And then one day, someone yells
"OUTBREAK OF RINGWORM"

- #1: Do not start moving cats around
- #2: Start AGGRESSIVE CLEANING
 - Mechanical removal of debris
 - Scrub, scrub, scrub, scrub..... and then Rinse...
 - Apply disinfectant at USUAL dilution
 - Do daily until a decision has been made
- #3: Collect information for the veterinary visit and assessment

IS IT AN OUTBREAK?

- What clinical signs were noted and when?
- Is it limited to a group of animals?, litter of kittens?
- Do staff have lesions?
- What diagnostics have been done? Wood's lamp? Direct examination?
- How was it confirmed? Fungal culture? What medium? Was it confirmed via color change or mycological exam? Collect plates if possible.
- What have you done so far?

SUMMARY

- Assess what your shelter can do
- Cleaning and decontamination (and clutter busting) recommendations for ringworm are a benefit for all infectious diseases
- Become competent with a Wood's lamp and direct examinations-litter of infected kittens is a good place to start
 - Confirms infection and treatment decisions can be made
 - Will help contain an possible outbreak

Disclosures

- Dr. Moriello has received research funding* and unrestricted gifts** for research from:
 - Winn Foundation for Feline Research*
 - Companion Animal Grant, University of Wisconsin*
 - Maddie's Fund**
 - DVM Pharmaceuticals**
 - Novartis Animal Health, Alpharma, Pfizer Limited**
 - *AND too many to count unrestricted gifts from private individuals whose generosity has allowed my laboratory to do research on questions of importance to our community and to help people and cats in need during outbreaks*
