Brains Over Fungus: How to Beat Dermatophytosis and Not Die Trying

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A Production of the Shelter Medicine Dermatology Project

A partnership between the University of Wisconsin School of Veterinary Medicine, UC Davis and the Dane County Humane Society
An enormous thanks to the incredible group of dedicated volunteers who were brave and driven enough to venture into this novel program. I can’t thank them all enough for making our project happen. We weren’t exactly sure where we were going but we know now that we are there.
Moriello. Thank you.

This project could never have happened without your years of expertise in the dark with cat hair.
Dermatophytosis = Ringworm

Not a worm... Just a fungus...
Fungus is a lot like us.

- The similarities between mammalian cells and fungal cells make it difficult to design drugs that will kill the fungus without killing us.

vigorous growth?
thrives in soil?
Anyone with hair and skin can be affected.
Who gets ringworm from shelter cats?

- Joey
- Joeys’s sister Zoey
- Zoey’s girl scout troop
- Zoey’s guinea pig.
- whose parents just adopted a new kitten
- who all came over to meet Joey’s kitten

and even
What about dogs?

- Bacterial skin infections are much more commonly reported
- Shelter dogs?
A word about recognizing and treating infectious disease with zoonotic potential in a shelter setting.

- The information in these talks is intended to help shelters work with veterinarians to design cost effective systems to screen, treat, and monitor for dermatophyte infections.
Where are we going?

- Diagnosis
- Treatment
- Evaluating and Cleaning Environment
- Outbreak Management
- Designing a Management Program
Diagnosis
The clearest, most definitive clinical sign of dermatophytosis is a positive, identifiable fungal culture... with a lesional, glowing cat.
But most cats don’t do math...
Fungal culture is the gold standard for diagnosing dermatophytosis

- Sadly, the clinical signs are not as clear as they might be.
- Thank heavens for jello.
What does a lesional cat look like??????

A “lesion” is any abnormality of the skin or hair coat.
Common Clinical Presentations

- Pruritus
- Hair loss
- Crusting and Scaling
- Erythema
- Comedones
- Hyper pigmentation
- Paronychia

- Not “localized”
- Focal or multi-focal
- Shedding
- Vomiting or hairballs
- Constipation
- Anorexia
Lesion and Reaction Patterns

- Milliary Dermatitis
- Eosinophilic Plaques
- Indolent Lip Ulcers
- Symmetrical Alopecia
- Over grooming
- Granulomatous lesions
- Pinnae Alopecia
- Anatomic Reservoirs
So...is that helpful?
Ringworm lesions can look like almost anything

......or nothing
No lesions

I have lice.
Classic Lesions?
Classic Lesions
Classic Lesions
Obvious Lesions
Subtle Lesions
Subtle Lesions
Subtle Lesions?
Missed Lesions
So how do you avoid missing one?

You need more than clinical signs.
You need Dermatophyte Test Media.
Always Be Suspicious

and choose your weapons carefully
Obvious Lesions That May Bite
Think beyond the obvious problem.

- Traumatic injury does not loosen fungal spores or knock them off of most cats.
Don’t rule it out without a culture

• Cat fighting does not decrease the risk of ringworm infection.
Diagnosis:
Wood’s Lamp Exam
Things that Glow in the Dark

Woods Lamp 101
(not just your funky 1960s black light)
Woods Lamp 101

- Invest in a good lamp.
- Wood’s lamps have UV wavelength that will cause the most effective fluorescence.
- Consider a magnifying glass.
- Emits long-wave UV radiation (UVR)
- 320 and 400 nm with a peak at 365 nm
Less favorite....

Lamp $69
Replacement bulbs $11.90
Turn out the lights, warm up the lamp, invite company

- Give your eyes time to adjust to the dark.
- Give the lamp time to warm up.
- You will need at least three hands.
Fluorescence is a metabolite of the fungus that coats the hair as it is produced. The fungus grows in the hair follicle and along the base of the hair. So, fluorescence will be seen most commonly close to the skin. Often the entire shaft of the hair will glow.
Ringworm Glow: Basics

- Apple-green
- Occasionally blue-white
- The whole hair shaft should glow
- Especially the base
- Fungal growth does not make the hairs stick together.
What is it that’s glowing?

- M. canis is the only pathogen of veterinary importance that fluoresces
- Estimated that only 50% of M. canis strains glow
- The truth is we don’t know how many strains glow and what factors influence fluorescence.
Tricky Things that also Glow

- Doxycycline
- Terramycin
- Carpet fibers
- Dust
Advanced Skills:

Direct Microscopic Exam of Hairs
Direct Exam
What if it doesn’t glow?

- A Wood’s lamp exam may help to identify skin lesions and hair loss even when there is no fluorescence.
- Quarantine
- Wait for culture results.
- Even glowing lesions should be evaluated with direct microscopic exam of hairs and a culture.
Diagnosis:
Fungal Culturing
How to Culture

- A toothbrush is an ideal means of collecting spores from the hair coat.
- Brush the whole cat vigorously from nose to toes.
- Remember to brush common areas of infection such as the face, inside the bell of the ears and tips of toes.
- For lesional cats, brush the whole cat first, then the lesion.
- Most cats love this!
Dermatophyte Test Media

- Fungal culture media.
- Contains an indicator that turns the media gel from orange to red as the pH of the media changes.
- Incubate at room temperature or slightly warmer. (78-80 F)
Inoculating Culture Media

• Always set up cultures in a clean area.
• Hold culture plates upside-down.
• Gently stab the tips of the toothbrush into the media.
• Cover the whole plate in a consistent pattern.
DTM

- Avoid using slants, if possible.
- Purchased petri dish style plates are currently the best alternative to making your own plates.
- Derm Duets from Bacti Labs as a substitute
- Treat fungal cultures as a biohazard for disposal.
Culture Interpretation

- Red only means “Look at me!”
- All pathogens turn DTM red.
- Not every organism that turns the media red is a pathogen.
Contaminant Growth

- Pigmented colonies are non-pathogenic contaminants.
- Contaminants are often common environmental organisms.
- Ringworm is never normal flora.
Culture Interpretation

- All suspect fungal colonies should be examined microscopically to identify the organism.

- Microsporum species are most common
  - *M. canis***
  - *M. gypseum*

- Trichophyton species may be pathogenic but are less common.
Microscopic Identification

*M. canis*  
*M. gypseum*
A screening system is the best guide to treatment

Screening exams and cultures define cases, direct animal movement and guide treatment protocols.
The P Scoring System

- Pathogen Score strongly influences treatment decisions
- Helps define cases
- Benefits from complete and consistent sampling method
- Must be used in conjunction with a thorough check for lesions
P1

- 1-4 colonies
- Dust mops
- Missed lesions
- Lesions in locations that are difficult to see or sample for culture
- Most are “Dip and GO…”
• 5-9 colonies
• “Dip and Go”…for most…but..
• Be absolutely sure there are no lesions
• Many cats with P2 cultures have subtle lesions found by the veterinarian 7-10 days post-admission
• Culture results give clear hind-sight
• Heavy fomite carriage is possible but uncommon
• Fungus heads
• Treat all as TRUE Infection
• Mechanical carriers will have earlier mycologic cure
Re-culturing

- Re-culture when contaminant overgrows the plate.
- Re-culture if new lesions are noted.
Treatment
Let’s get one thing out of the way…
What Doesn’t Work

- Lufenuron (Program)
- Ringworm vaccines
- Localized topical treatment

- Use well researched treatments.
- Treatment failures can be catastrophic.
Treatment Basics

- Topical treatment kills the spores on the hair-coat and skin
- Systemic treatment affects the fungus below the skin surface and in the hair follicle.
Treatment Options Based on Pathogen Score

Screening Culture and Exam at Admission

Wood's Lamp positive, confirmed infection via direct microscopic exam of hairs

Treat as True Infection while awaiting culture results

Fungal Culture P score Results

P1 or P2
Check for lesions
Check difficult to see or difficult to culture anatomic locations
Skin Lesions?

NO
DUST MOP

"DIP and GO..."

YES

Treat as true infection

P3

***Always treat as true infection

Lyme sulfur and Itraconazole

Lyme sulfur and Itraconazole
Introducing the Dust Mop
Mechanical Carriers vs. True Infection

• Mechanical carriers are animals who have spores, like dust, on their hair coat from the environment.

• True infection happens when micro-trauma allows fungal spores to invade the skin and hair to establish growth.
Dip and Go…

- Goal is to remove spores being mechanically carried on the coat
- Re-culture, topical lime-sulfur, move on to adoption
- The cats are really doing the work
- Cats with P1 cultures and no lesions had no growth of pathogens on their re-check cultures
“Only one of the 2 cats is affected and the rest of his bloodwork is normal; is it a fluke that this dsh cat broke with this infection.”

Who should we treat?
Treating for true infection

• Minimize potential for re-infection.
• Combine topical and systemic treatment if possible.
• Protect staff and volunteers from zoonosis.
Where to Treat

- Cage confinement limits environmental contamination, risk of zoonosis, and potential for re-infection.
Create an isolation facility
Staff and volunteer training

- Create clear, easily understood written procedures
- Post instructions
- Get feedback and explain logic behind protocols
- Compliance, compliance, compliance
Mandatory Dress Code

• Prevention of zoonotic infection should be the top priority.
Treatments and Cleaning

- Treat and clean in order of infectious potential
- Infectious potential may change weekly
- Define clean and dirty zones
Topical Anti-fungal Treatment
If you can only afford one treatment...

...go for the wet and smelly.
How to make a dip sink

- Cheap
- Portable
- No need to call a plumber.
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.
Dilution and Mixing

- 8 oz LymeDyp to 1 gallon water
- Higher concentration dilution on label
- Mix by putting 8 oz. LymeDyp in the sprayer then fill to 1 gallon
- Mix fresh solution each time, discard excess
The Dyp Show

• DO NOT KISS THE CAT!! (at least until after)
The Dyp Show

- Use gentle but firm handling.
The Dyp Show

• Keep the spray close to the skin.
The Dyp Show

- Allow most cats to find a secure place to hold on.
• Soak the entire cat to the skin.
• Treatment must reach the base of the hairs to be effective.
• Pre-wetting is unnecessary and causes dilution.
The Dyp Show

- A small sponge or raglet may be used for the face and ears.

- The face and ears are the most difficult places to clear of infection.
The Dyp Show

- No need for party hats
- Minimal side effects
- No significant adverse reactions
Systemic Anti-fungals
**Itraconazole 101**

- 5-10 mg / kg by mouth once daily for 21 days
- 25 mg per adult cat per day
- 100 mg caps can be split into 25 mg doses with a steady hand and some gel caps
- Liquid is available for dosing kittens but more costly
Systemic Anti-Fungals: Alternate Options

- Griseofulvin
- Fluconazole
- Turbenafine
Griseofulvin

- Toxicity
- Bone Marrow Suppression
- Hard to get
- Screen for FIV
- Not for debilitated patients
- Static only, so longer days to cure
Fluconazole

- Related to Itraconazole, but probably less efficacious
- Recently went generic
- Unpublished data suggests need for 10 mg / kg (higher than Itraconazole).
- Unknown if it has same binding in stratum cornea layer of the skin as Itraconazole.
- May not be appropriate for pulse therapy.
Fluconazole vs. Itraconazole

• In vitro MIC comparison for *M. canis*
• Itraconazole 0.8 mg/L
• Fluconazole 16 mg/L

Turbenafine

- Published dose 5-10 mg/kg but actual studies must use 30-40 mg/kg
- Hugely expensive
- May not be as efficacious
There’s more than one way to pill a cat

- Itraconazole does not appear to effect palatability if mixed with food items
- Most cats agree…”Butter balls taste great!”
Ending treatment?
Re-check cultures

- Weekly re-checks will limit treatment days and get kittens moving on their way home.

- For most shelters, cultures cost less than prolonged animal care days.

- Cost break down of prolonged treatment vs. weekly cultures and early knowledge of mycologic cure.

### DTP Treatment

#### 6 Weeks

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Wood’s Lamp Re-checks

- Hairs may continue to fluoresce during treatment.
- Fluorescence will move to the tips of the hair and become weaker as cure develops.
When to discontinue treatment

- When lime-sulfur is used, mycologic cure may precede resolution of clinical signs

- Hair re-growth may precede mycologic cure when topicals are not used or limited

- Always base ending treatment on culture monitoring
Graduation

- Re-writing GOSPEL
- (Eating crow)
- Two negative fungal cultures
- Each taken one week apart
- Each held a minimum of 14 days
## Graduation Cultures

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<td></td>
<td>Identification culture</td>
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Evaluating and Cleaning the Environment
Treating the Environment

- No need for anything fancy
- Elbow grease
- Think dust
- Bleach??
- 10 min contact
- 1:10 bleach concentration
- Not Trifectant?
- Schedule regular environmental monitoring cultures
- Target cleaning with environment monitoring
Crime Scene Clean-Up

“Is it rational to even consider sending them back to that same home which we believe to be contaminated with ringworm spores? Do we give this lady info on how to disinfect her home and if so will she be upset enough to point a finger at our shelter?”
Public Health and Safety

“What we'd really like would be some great technical info that would convince her that it is just as well to have the cats in her house during their treatment.”
Foster Homes

Environmental Cultures
Triple Clean Method

Think DUST and picture Pig Pen.

If you are going to treat in foster care, confine the cats to cleanable areas.

And culture the environment afterwards.
Outbreak Management
Disaster Management

- Stick with what you know
- Be patient
- Evaluate risk
- Hard decisions are easier if you have a plan
- Quarantine / Limit movement
- Culture / Dip / Culture / Dip
- And Clean
Designing a Management Program
Start small and be successful

- Don’t bite off more than you can chew
- Take baby steps
- One foot in front of the other
- Rome wasn’t built in a day
- 100 pennies make a dollar
Implement a treatment protocol

- Use a clear treatment protocol based on case definitions that will allow assigned staff to move animals and start treatments if indicated.
- Involve your veterinarian in the planning process.
Budgeting

• Don’t plan for what you can’t afford to do
• Be creative, ask for help, shop around
• Consider animal care days when budgeting
• Encourage volunteer participation
Stick to your protocol

- Keep written records.
- Monitor and evaluate the system.
- Make changes as needed.
Choose your battles

• Fungus is a poor selector of adoptability.
• Shelter managers make better choices.
• The first goal for any infectious disease control program is to protect the healthy animals.
Sometimes there is no choice

- Protective Custody
- No kill shelters
- Foster homes
Treatment vs. Removal

- Recognize and euthanize policies may not solve the problem.

- RECOGNIZING is the hardest part.

- Compliance and morale of staff and volunteers is essential for a successful program.
At DCHS treating for dermatophytosis actually lowered the level of shelter-wide environmental contamination and cat to cat transmission.

But you do need to be careful.
Whenever Possible, Screen Everyone

• Have I mentioned biosecurity?
• Did I say you should be cautious and a little bit paranoid??
• Have I mentioned culturing?
At least screen for lesions and culture ALL the lesional cats you think you might want to put up for adoption.

Admission is the control point for infectious disease.
Why is screening so important?

- Public safety
- Outbreak prevention
- Foster homes
- Life and death decisions
- **Because there is no other way to know**
“One of our fosters wanted to adopt this shy pair so they were sent to her house on a foster basis until their uri was cleared at which time we'd go thru with the adoption. We got the cats from the local pound 2/8/06 with no skin probs; admittedly I failed to repeat a full phys exam when they went to foster on 2/21.”
“On 2/23, foster phoned to ask about the bald patches on one of the cats; we brought him in and he has a nasty case of ringworm; verification of microsporum came thru 3/7. Foster does some work as a nanny for wealthy peoples’ kids.”

Two more weeks
“When ringworm was confirmed, she decided she does not want the cats in her home during their treatment. Cats had been at her home for 10-12 days before they were returned to shelter, where we have started twice/week LymDip and will shortly start itraconazole.”

“Conundrum is this lady really wants to adopt these two cats.”

At least four weeks more
“All told, it will cost our shelter hundreds to get these two cleared of ringworm (2-3 consecutive negative fungassays).”

$$((2\times7)+(2\times7)+(4\times7)) \times 6 = 336 \times 2 = 672$$  just in animal care days
### Screening Cost Breakdown

- Shop around for media suppliers
- The cost of not screening can be devastating
- Vaccinate first, then screen.

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**Total Cost:** 16.32
• Choose a few great cats at a time and treat appropriately instead of treating a whole group ineffectively and risking disaster.
Why treat when self-cure is possible?

SHELTER FACTORS
- Animal care days
- Environmental contamination
- Disease transmission
- Outbreak prevention

You are not just treating the cat…
You are protecting the environment.
Why treat?

Shelter Cats are not house pets …or research cats

ANIMAL FACTORS
• Stress
• Concurrent Illness
• Immune Suppression
• Severity of Infection
• Body Condition
Prognosis

• USUALLY GREAT!!
• Look at the whole cat
• Most cats will cure

• When cure is prolonged
  • Evaluate treatment choice
  • Evaluate environment
  • Evaluate compliance
  • Diagnosis?
Zoonosis
Zoonosis
Zoonosis
Resources

- [www.giveshelter.org](http://www.giveshelter.org) click on got ringworm?

- [www.sheltermedicine.org](http://www.sheltermedicine.org)

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Questions?