Order Strongylida

Superfamilies:

- Trichostrongyloidea
- Strongyloidea
- Metastrongyloidea
- Ancylostomatoidea (hookworms)
ORDER STRONGYLIDA - Bursate worms
Superfamily - Ancylostomatoidea

HOOKWORMS
*dorsally flexed anterior
* adult: small intestine
(10-16 mm)
1. *Ancylostoma*

TEETH

2. *Uncinaria*

CUTTING PLATES

- Strongyle-type eggs in dog or cat feces = “HOOKWORM” eggs
• Ancylostoma species of importance
  
  *A. caninum* - DOGS
  *A. tubaeformae* - CATS
  *A. braziliense* - DOGS & CATS
  
  *A. duodenale* - HUMANS
**Ancylostoma caninum**

- SOUTH-EASTERN STATES, most prevalent helminth in dogs
  - ~20-40% in shelter dogs
Blood-feeding parasites

Morbidity and potential mortality!
A. caninum adult

...taking a ‘bloody’ bite of mucosa!
Egg---L1---L2---L3

5-7 days

Infective L3 larva
Infection from the environment by:

- Ingestion of L3
- Skin penetration by L3
- (Ingestion of paratenic host)
Two choices for an L3 larva:

1. NORMAL DEVELOPMENT
   L3 → L4 → Adult

OR

2. ARRESTED DEVELOPMENT
   (‘hang out’ as L3 in muscle, organs)
When do arrested L3 larvae reactivate?

STRESS  DEWORMING  PREGNANCY

REACTIVATION of tissue-arrested L3s

SELF-REPOPULATION
L3 to adult stage
in small intestine

TRANSMAMMARY TRANSMISSION
L3 in milk
to pups but not kittens
Transmammary transmission

• Migration to mammary glands
• Transmission in milk to nursing pups during lactation
• Experimental observation:
  – 1 infection of dam can contribute to transmission of infection to at least 3 subsequent litters!
Getting rid of arrested larvae?

• metabolically quiescent
• relatively resistant to host defense mechanisms and to drugs
• negative fecal analysis?
What are the different ways by which dogs and cats can acquire *Ancylostoma* infections?

*Ancylostoma caninum*  
• Primary route is lactogenic  
• Ingestion from environment  
• Skin penetration from environment  

*Ancylostomum tubaeformeae*  
• No lactogenic transmission in cats  
• Primary is ingestion from environment
Pathogenesis & Clinical signs

Adult worms are blood-feeders -- need oxygen/nutrients

Consequences to the host:
- ANEMIA
- BLOODY DIARRHEA
Pathogenesis

- Hemorrhage  
  (Why does blood not clot?)
- Some damage to intestinal mucosa
- Larval migrations may cause some pathology  
  (e.g. respiratory signs but this is not common)
Clinical Disease

• Acute anemia in nursing puppies
  * PCV down to 10+% from 35-57% (normal)
  * Blood loss from 50-100 adults ~3 ml/day
  * Mortality between 8 and 24 days of age

• Chronic disease: weight loss, poor body condition, especially in older or immunocompromised animals

• Clinical disease very common in dogs but not in cats
Host resistance - Adult dog

- acquired immunity (not complete)
  - prone to re-infection
- premunition (inhibition of further infection due to residual population)
- ability to compensate for blood loss
Treatment & Control

- Warm, moist conditions favor L3 survival, do not tolerate desiccation
- **Newborns:**
  - TREAT with anthelmintic at first sign of disease (Improvement = Diagnosis)
  - +/- BLOOD TRANSFUSION
  - +/- Iron supplementation, vitamins, protein
• **Puppies**: deworm every 2-3 weeks, until starting monthly heartworm preventative
• Keep runs clean and dry; bleach washes
Treating pregnant dogs to prevent infections in puppies

- Fenbendazole - every day from day 40 of gestation to day 14 of lactation (~ 40 days!)
- Selamectin and possibly other monthly avermectin prophylactic drugs timed to coincide with whelping. Much easier than above
Zoonosis #1

Infective L3s can penetrate human skin and.....

1. Cutaneous larva migrans
   * erythematous pruritis
   * *A. braziliense; A. caninum*
Zoonosis #2 (FYI not on test)

Uncommon eosinophilic gastro-enteritis

*A. caninum*

Infected L3s penetrate human skin and find their way to the intestine
- typically 1 or 2 adult worms only
- not patent
- tummy ache!
Uncinara sp.

- less common hookworm of dogs
- relatively non-pathogenic
- no transmammary transmission, only infected by ingestion of L3
Order OXYURIDA

- Pinworms of the large intestine
- Adult worms have long tapering tail
- Worm most often seen by horse owner
- Host-specific
  - *Enterobius* is a human pinworm
  - Cats and dogs do **NOT** have pinworms
  - **Horses:** *Oxyuris equi*
Long tapering posterior
Oxyuris equis

- HORSES
- large, white, thick-bodied adults
Life-cycle of *Oxyuris equi*:

- Adult female in large intestine, migrates to the anus and deposits eggs in a sticky fluid on perianal area

- Fluid dries and flakes off with eggs

- Infective L3 mature within the egg shell in 4-5 days; ingested by the horse
Life-cycle of *Oxyuris equi*:

- L3s in large intestine mature to adulthood
- Prepatent period ~ 5 months
- EGGS: single operculum
Pathogenesis/Clinical signs:
1. large numbers of adults/larvae → colitis
2. eggs/sticky fluid → perianal itching
   bare ‘tailhead’
Diagnosis and Treatment

**Diagnosis:**
‘sotch-tape’ pressed around perianal area; examine for operculated eggs

**Treatment:** ivermectin or daily pyrantel