Order Strongylida

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

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

TEETH

• Strongyle-type eggs in dog or cat feces
  = “HOOKWORM” eggs

2. *Uncinaria*

CUTTING PLATES
• Ancylostoma species of importance

  A. caninum - DOGS
  A. tubaeformeae - 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

Infected 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 $\rightarrow$ L4 $\rightarrow$ Adult

   OR

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

REACTIVATION of tissue-arrested L3s

SELF-REPOPULATION
L3 to adult stage
in small intestine

TRANSMAMMARY TRANSMISSION
L3 in milk
to pups but not kittens

STRESS DEWORMING PREGNANCY
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
- No transmammary
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 (Diagnosis?) +/- BLOOD TRANSFUSION +/- Iron supplementation, vitamins, protein
• Puppies: deworm every 2-3 weeks, till start 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*

Infective 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:**
‘scotch-tape’ pressed around perianal area;
examine for operculated eggs

**Treatment:** ivermectin or daily pyrantel