Intestinal Nematodes

A group that extends from minor to major pathogens
**Trichuris trichiura**

- The whip worm, named for its shape
  - Lives in large intestine down to rectum
  - Adults are threaded through mucosa
  - Adults live several years, thus producing large worm burdens
  - Simple, direct life cycle: eggs to soil to mouth hatching to adults in intestine threading into mucosa

*Whipworms threaded through mucosa*
Epidemiology of whip worm

• Two conditions for disease:
  – poor sanitation
  – appropriate conditions to promote embryonization
    • warm climate
    • moist conditions
    • dense shade
• Often co-infection with *Ascaris*
• Infected eggs directly from soil
  – night soil
  – geophagy
  – house flies
• 750 million cases

Night soil, human feces used as fertilizer
Pathology of *Trichuris*

- Pathology = worm burden
  - >100 worms needed
- Heavy infections can be fatal
  - Infections of 200-1000 worms not uncommon
- Pathology
  - dysentery
  - anemia
  - growth retardation
  - prolapse rectum
- what’s the cause?

Tenesmus & prolapsed rectum
Pathology continued

• Moderate to heavy infections
  – adversely affect cognitive function
  – worms feed on cells and blood
  – rectal tenesmus
    • leads to prolapse rectum
  – blood streaked stools

• diagnosis & treatment
  – characteristic eggs
  – drug of choice: Mebendazole

*Embryonated egg of Trichuris*

*T. trichiura typical egg*
Enterobius vermicularis

• The pinworms, different spp infect a variety of animals and birds, *E. vermicularis* is strictly a human parasite.

• Ancient parasite, probably a human “companion” from the beginning.
  – In Utah human coprolites from 7800 B.C.

• Unlike most parasites, this one favors temperate to colder climates

• Economics do not play a role an “equal opportunity” parasite
  – although more common in orphanages, day care centers, mental hospitals, etc.
Epidemiology of pinworms

- >400 million cases
  - a irritation, like dandruff and acne
  - little being done to control this infection
  - pathology is low, but probably underrated
  - some cases may be serious

Enterobius vermicularis
Life cycle of *Enterobius*

- Fecal/oral route
  - Under fingernails
- Adults range from stomach to anus
  - Ileocecal region
  - Live on fecal debris & bacteria
  - Gravid females leave anus to lay eggs
    - In perianal folds
    - 4000-16000 eggs each
    - Eggs embryonate within 6 hours
    - Itching/scratching eggs under fingernails/mouth
Life cycle & epidemiology

- retroinfection-juveniles
- clothing & bedding rapidly filled with eggs
- eggs everywhere
  - NY schools 100/sq.ft.
  - highly infectious
  - may become airborne and inhaled
  - impossible to prevent spread through family
  - dogs & cats not infected
  - school is best place to get infected!!

Embryonated *Enterobius* egg
Pathogenesis

• Most asymptomatic
  – vague symptoms
  – damage to mucosa
    • inflammation, bacterial infections
    • may invade submucosal surface--serious!!
  – Perianal pruritus
    • Sleep disturbances
  – More pathogenic in females
    • vulva-vagina-uterus-peritoneum-bacterial-granulomas
  – major symptom: Pruritus ani, pruritus vulvi

Necrotizing granuloma in omentum due to eggs of Enterobius
Diagnosis and Treatment

• Role in transmission of *Dientamoeba fragilis*

• Scotch-tape test

• characteristic eggs

• fecal sample no good

• Treatment
  – Albendazole
  – Mebendazole
  – treat all family members--hope for the best

Scotch-tape test, before the bath
Ascaris lumbricoides

- Large (3-8”) round worm of humans.
  - Little difference between *A suum* ?, Humans probably got it at time of domestication of pig
- Most common helminthic infection, >1 billion infections
- From asymptomatic to serious disease

Ascarids removed from fatal case in Capetown South Africa
Life Cycle of *Ascaris*

- Embryonization takes 9-13 days in soil
- hatch in duodenum
- juveniles penetrate to circulation to lungs
- molt in lungs--10 days
- migrate bronchial tree
- swallowed to gut
- mature to adults in 60 days

*Life cycle of Ascaris lumbricoides*
Epidemiology

- Eggs remain infectious for 10 years
- Legendary chemical resistance in eggs
- SE USA, infection rate 20-60%
- Nasal mucus of USSR children = 3.2%
- Even on German bank notes

Unbryonated ascarid egg

Embryonated ascarid egg
Pathogenesis

• Migrating larvae
  – potent allergens
  – ascaris pneumonia
    • larvae in sputum
  – bacterial infections
  – asthma
  – diseased lungs

• Adult infections
  – under nourishment
  – abdominal pain, eye pain, asthma, insomnia

• Intestinal blockage
  – often fatal

Intestinal obstruction in fatal case from 2 year old child
Pathogenesis continued

- Penetration to peritoneum
  - not common, but does occur
  - 35% all deaths due to abdominal emergencies in Capetown

- Wandering worms
  - some serious, some bizarre, all unpleasant
    - tropism of females to squirm thru coiled tail of male, so if no males--
      - Females begin to wander

Tail of male ascarid with spicule (reproductive organ)
Pathology continued

• Migrations into
  – pancreas, bile duct, liver, out anus — (surprise)
  • obstructive jaundice
  • blockage of ducts
  – Into stomach where acid induces writhing and gag reflex
    • explosively expelled via mouth, nose, ears, wow!
    • extreme psychological trauma (to say the least)
    • nocturnal migrations to oesophagus to trachea—suffocation

Migrating worms in liver
Diagnosis and Treatment

- Females contain 27 M eggs released at 200,000 per day
  - typical eggs in stool
- Adults seen on barium enema
- Juveniles in sputum?
- Treatment:
  - Mebendazole

Ascarids expelled following anthelminthic treatment