MUCOFLAGELLATES: TRICHOMONADS, GIARDIA

General Morphology of Mucoflagellates
A. Cell body
   • Shape – Pear-shaped (Giardia), spindle-shaped (trichomonads)
   • Special organelles
     o nucleus (single or double)
     o flagellum (multiple)
     o undulating membrane (present or absent)
     o axostyle = a stout median rod (present or absent)
B. Genotype-specific host-pathogen interactions
   • Bovine Tritrichomoniasis
   • Feline Tritrichomoniasis

Tritrichomonas foetus bovine
Bovine Genital Trichomoniasis
A. Morphology
   • Trophozoites only
   • Spindle-shaped (some-what pointed at both ends)
   • 3 anterior flagella, one posterior flagellum with undulating membrane
   • Axostyle present
B. Life Cycle
   1. Bovine Reproductive systems (prepuce, penis, vagina, uterus, fetus)
      • Direct life cycle – venereal disease, transmitted from bulls to cows
      • No Cyst stage
      • Multiply by binary fission
   2. Transmission
      • Sexually transmitted during copulation
      • Artificial insemination via contaminated semen
C. Pathogenesis (definitive mechanism has not be confirmed)
   1. Cow’s immune / inflammatory reaction may be destructive to fetal-maternal tissues
      a. Trichomonad contact causes autoimmune/inflammatory response, excretions, or enzymes
         may be cytotoxic to fetal / maternal tissues
      b. Causes vaginitis and endometritis, leads to abortion, pyometra, or infertility
   2. Bulls trophozoits attach to penis, prepuce and distal portion of the uretha
      a. No damage to cells, no change in bull or semen, bulls serve as reservoirs
D. Clinical Disease
   1. Complaint -- Abortions (early to mid-term), failed pregnancy, infertility suspect
   2. Pathological findings -- vaginitis, cervicitis, pyometra, endometritis, mummified fetus
E. Diagnosis
   1. Most Dx are done to detect in the bull
   2. Bull -- Preputial wash or scrapings
   3. Cow -- History of abortions, cervical mucus, uterine fluid, fetal tissue
   4. Lab -- Fresh wet-mounts for trophozoite, culture kits, PCR
   5. Positive results are reportable
F. Treatment – none available
G. Control
   • Strict surveillance of bulls
   • Cull infected bulls, replace with young bulls
   • Use hygienic AI
   • Vaccines (not-complete protection) [Trichguard, TrichGuard V5L]
H. Epidemiology
   • Bulls -- permanently infected / infective; prevalent in >4 years of age.
   • Cows -- Immune response can eliminate infection if left unbred for 3-4 months with partial
     immunity (immunity is only temporary against reinfection).

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**Trichomonas blagburni**

**Large Bowel Feline Trichomoniasis**

A. **Morphology**
   - Trophozoites only
   - Spindle-shaped (somewhat pointed at both ends)
   - 3 anterior flagella, one posterior flagellum with undulating membrane
   - Axostyle present

B. **Life Cycle**
   1. Feline large intestine
      - Direct life cycle – fecal-oral contact
      - No Cyst stage
      - Multiply by binary fission
   2. Transmission
      - Ingestion of trophozoite in feces.

C. **Pathogenesis (Suspect contributing factors)**
   1. Indirect tissue destruction (extracellular, cytotoxic effects on cell surface)
   2. Interactions with endogenous bacterial flora
   3. Adherence to host mucus and epithelium
   4. Elaborations of cytotoxins and enzymes
   5. Activation of host immune / inflammatory response
   6. Rarely – invasion of sub-epithelial tissue

D. **Clinical Disease**
   1. Complaint – Intermittent, chronic diarrhea
   2. Pathological findings -- large bowel diarrhea (frequent defecation, small volume of feces, tenesmus (straining), increased urgency, mucus may be present)

E. **Diagnosis**
   1. Motile trophozoites on fresh wet-mounts
      - Don’t confuse with Giardia
   2. in vitro culture kit with PCR

F. **Treatment**
   1. Ronidazole {Tricho Plus} (30 to 50 mg/kg every 12 hrs. for 14 days) [be alert for neurotoxicity]
   2. Unresponsive to metronidazole.

G. **Control**
   - Strict hygiene in group housing and cat shows.
   - No cyst so organism does not persist in clean, dry, aerobic environment
   - Survives several days in feces

H. **Epidemiology**
   1. Cats from High density populations, group housing
      - Catteries – Breeding and boarding
      - Pure-breed show cats
**Giardia spp. complex** (*G. duodenalis ~ G. intestinalis ~ G. lamblia*)

**Giardiasis** (acute or chronic diarrhea)

A. Morphology
   - Trophozoites
     - Tear-shaped (rounded anteriorly)
     - 2 bilateral nuclei
     - Ventral “adhesive disk”
     - 4 pairs of flagella (1 anterior pair, 1 posterior pair, 1 ventral pair, & 1 caudal pair)
     - Pair of median axonemes that give the appearance of an axostyle.
     - 2 crescent-shaped median bodies – dark staining organelles of undetermined function.
     - No undulating membrane
   - Cyst
     - Ellipsoidal
     - Cyst “wall” containing 2 developed trophozoites
     - 4 nuclei
     - Axonemes
     - 4 median bodies

B. Life Cycle
   1. Small intestine on mucosal surface.
      - Direct life cycle – fecal-oral contact
      - Ingest cysts; excystation releases trophozoites
      - Trophozoites multiply by binary fission
   2. Transmission
      - Ingestion of cyst from feces
        - Fecal-contaminated water, food, or fomites, or self-grooming
        - (Ingested trophozoites will not survive)

C. Pathogenesis
   1. Trophozoite attachment to surface of epithelial cells of small intestine
      - Damages epithelial cells, blunts intestinal villi
      - Causes dysfunction of epithelial cells
      - Maldigestion, malabsorption, diarrhea

D. Clinical Disease
   1. Complaint – Persistent Diarrhea: watery to loose, fatty, strongly malodorous
   2. Pathological findings -- Fatty diarrhea, malabsorption syndrome

E. Diagnosis
   1. Direct fecal analysis (intermittent shedding makes this difficult)
      - Loose stool: Motile trophozoites on fresh wet-mounts
        - In cats: don’t confuse with Tritrichomonas
      - Solid stool: Cyst stage – don’t confuse with yeast
        - Fecal float centrifugation with zinc sulfate solution
   2. Antigen detection kits, ELISA (SNAP Tests)
      - Rapid in-house; high specificity
   3. Combine direct fecal with antigen tests increase sensitivity

F. Treatment
   1. Dog: Metronidazole [Flagyl], Fenbendazole [Panacur], Febentaul-pyranter-praziquantel [Drontal plus]
   2. Cat: Metronidazole [Flagyl], Fenbendazole [Panacur], Febental-pyranter-praziquantel [Drontal plus]
   3. Calves: Fenbendazole [Panacur], Albendazole [Valbazen]
   4. Companion Animal Parasite Council (CAPC) recommends treating only symptomatic dogs & cats to decrease development of antiprotozoal resistance.
   5. Refer to CAPC ([https://capcvet.org/guidelines/giardia/](https://capcvet.org/guidelines/giardia/)) guidelines for up-to-date treatment protocols
   6. Treatment failure may be from reinfection, improper doses, immunosuppression, and drug resistance.
   7. In some dogs, clinical signs may resolve but fecal diagnostics remain positive.

G. Control
   1. Prevent fecal contamination
   2. Sanitation and disinfection of environment with a chlorine bleach product
H. Epidemiology
   1. Pets from high density situations
      • Catteries, kennels, shelters, dog parks
I. Zoonosis
   1. Giardia molecular assemblages seem to be rather host specific.
      • Cat and dog strains do not cross-infect
      • Human to human infection primarily
      • Rarely is there transmission from dog to human (concern for immunodeficient people).
      • Subtypes within assemblages may vary in host specificity
         o Assemblage A-I – Humans, dogs, cats, other animals (rare zoonosis b/w dog & human)
         o Assemblage A-II – Humans
         o Assemblage A-III & A-IV – exclusively animals (unspecified)
         o Assemblage B -- Humans & various animals
         o Assemblage C & D – Canines
         o Assemblage E – Alpacas, cattle, goats, pigs, sheep.
         o Assemblage F -- Felines

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