Johne’s Disease

*Mycobacterium avium subsp. paratuberculosis* (MAP)

**Classic case:** Thin, older dairy cow, chronic diarrhea, good appetite at 1st

*VERY IMPORTANT DISEASE* - *WORLDWIDE DISTRIBUTION POSSIBLE IN ALL RUMINANTS*

“A chronic contagious granulomatous enteritis characterized by diarrhea, progressive weight loss, debilitation and death” – Merck Veterinary Manual

**Presentation:**
- **Primarily DAIRY CATTLE**: up to 20-50% of dairy herds
- Cattle, sheep, goats, camels, deer, and elk can all get MAP
  - Prevalence underestimated in sheep/goats
  - Tested less often, diarrhea often not seen

**Bovine**
- Alert, no fever
- **Chronic/intermittent DIARRHEA**
- Loose → pea soup → watery
- Appetite good at first
- Milk production ↓s w/ protein levels
- Weight loss, debilitation emaciation
- Submandibular, ventral edema

**Sheep/Goats**
- **Weight loss is #1**; Weakness
- Diarrhea **not** common, intermittent
- Wool break - shed wool/hair easily;
- Submandibular edema in late stages
- Decreased milk production

**Necropsy:**
- Thickened, **corrugated intestine**, esp terminal ileum; enlarged/edematous lymph nodes
- Necropsy:
  - Foci of caseation w/ calcification of **intestinal wall and lymph nodes**; enlarged distal mesenteric lymph nodes

**Epidemiology/Transmission:**

- **Transission**
  - **Management** important – comingling of age groups and species, stocking density
  - **Infection pressure** important – exposure to high #s bugs = more likely to become infected
  - **Age** – younger animals infected more easily
- **# 1 mode of transmission** Fecal-oral; also passed in colostrum, milk; intrauterine
  - Large ## organisms passed in feces
  - Shedding begins **prior** to onset of C/S
  - “SUPER-Shedder” cows may pass $10^6$ CFU/gram feces
  - “Silent” shedders are #1 mode of transmission
- **Clinical disease**
  - Usually seen in cattle > 2 yr
  - May see disease in younger sheep and goats
  - Subclinical bovine cases may be ADR
  - If clinical signs evident, DEATH is inevitable
- **Strains**
  - Cattle strains affect many species of ruminants
  - Sheep susceptible to sheep strain, not cattle strains

**Corrugated intestine, Johne’s disease**
Differential Diagnosis:

**CHRONIC DIARRHEA**
- Parasitism
- Chronic Bovine viral diarrhea
- Salmonellosis
- Eosinophilic enteritis
- Renal amyloidosis, Glomerular dz
- Congestive heart failure
- Intestinal neoplasia

**WEIGHT LOSS**
- Malnutrition
- Starvation
- Fat necrosis
- Chronic peritonitis
- Cobalt or Cu deficiency

In *deer and elk*, think of [chronic wasting disease](https://en.wikipedia.org/wiki/Chronic_wasting_disease) (CWD)

**Test(s) of Choice:**

- **Depends** on situation:
  - Breeding animals
  - Commercial vs pet herds
  - Dairy vs. beef vs. sheep/goats, wildlife species, etc
  - Surveillance vs. control vs. individual diagnosis
- Pooled fecal samples used to investigate prevalence and in surveillance for control programs
- Environmental fecal samples may be used for surveillance
- Individual samples to diagnose clinical cases & identify subclinical cases

- **Organism Detection** tests
  - **Gold standard** – Culture *M. paratuberculosis* from feces or postmortem specimen
    - Difficult to culture, takes many weeks, use USDA-approved labs
  - PCR on feces
  - Histopathology
    - Used in breeding animals to obtain and maintain negative status
    - Confirm diagnosis in clinical cases

- ELISA used in control programs and in known positive herds
  - Milk, serum, or plasma
  - Positives are reliable, can be graded via magnitude of response
  - False negatives are possible
  - In goats, may cross react with *Corynebacterium pseudotuberculosis*

**Herd wide testing is not useful, and is a waste of resources unless management is appropriate.**
Treatment/Control/Prevention

- No satisfactory treatment – **CULL clinically affected animals**

- Control
  - can take several years, requires constant management oversight
  - Utilize screening tests

- Prevention – depends on species, type of group involved
  - Difficult where co-mingling is prevalent, ie beef, sheep, goat herds
  - Document herd status/prevalence via testing
  - Buy replacements only from MAP negative herds
  - Quarantine and test replacements
  - Many recommendations involved – one example below:
    - Maternity protocols for dairy cows
      - Multiple use maternity pens for negative cows only
      - Use milk replacer for calves from positive dams
      - No pooled colostrums, give colostrum from negative dam to her calf

- Vaccines - several exist for various species. Results are improving; some interfere with TB tests

Pearls:

- *M. avium subsp. paratuberculosis*: Acid-fast bacteria; difficult to culture
- TOUGH BUG-Survives > 1yr in soil, longer in water; survives pasteurization!
- Control programs present in many nations – serious economic impact; still voluntary in US
- Pathogenesis – Fecal-oral transmission is most common
  - Usually infected very early in life
  - Multiplies in lower SI, enters Peyer’s patches; spreads to macrophages in GIT & LNs
  - Chronic granulomatous enteritis
    - Malabsorption/maldigestion; protein-losing enteropathy
    - Eventually bacteremia and dissemination to other organs

- Passive fecal shedding—may see pos cultures in uninfected animals; esp w/ super-shedders in herd

- **REPORTABLE** in Sheep/Goats in **all US states**; in **some** states for CATTLE

- ****Potential zoonotic risk to humans; Possible relation to Crohn’s disease in humans; review by the American Academy of Microbiology

- **LOOK FOR JOHNE’S DISEASE** in any ruminant that has chronic wasting +/-diarrhea

- Resistance to disease differs:
  - Cattle >> Sheep > Goats
  - Some genetic resistance may be present – less disease in certain lines
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Extended version


My Notes: