Eliminating Chronic Disease Using a Farm-based Approach:
Caseous Lymphadenitis (CL)

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1) “Cheesy gland”: Chronic bacterial infection
   *Corynebacterium pseudotuberculosis*
   - Stays in the immune system
   - May cause skin or internal abscesses

2) Can be spread from animal to animal:
   - Must have skin penetration

3) Persistent in the environment

4) Use antibody response to test for presence of bacteria in unvaccinated animals

5) Vaccines are available; not highly effective
Corynebacterium pseudotuberculosis: lymph nodes

1. External: Firm, dry abscesses - slow to develop
2. Internal: Weight loss, coughing
CL: Internal abscesses (goat at necropsy)

Chest wall lifted away from lungs to show inflammation due to CL abscess.
CL: Internal abscesses (goat at necropsy)

Lung tissue with CL internal abscess (opened) showing dry exudate.
CL: How contagious is it?

- **Transmissibility**
  - Direct inoculation of bacteria into new host
    - Cut or ulcer, contact with exudate
    - Bites from flies that have contacted exudate
    - Rubbing on tree, etc, that has exudate on it
  - Inhalation of infected secretions
    - Sheep with bronchial lymph node abscesses: coughing
  - Milk?
    - If mammary lymph infections present
    - See more recent info (below)
CL: Can it be cured?

Treatment:

– Vaccines or antitoxins:
  • Don’t prevent or cure, but may decrease abscesses

– Immune clearance ineffective
  • Toxins overcome normal immune defenses

– “Hides out” inside cells
  • Uptaken by macrophages; survives and is spread to lymph nodes

– Antibiotics
  • In vitro, many are effective
  • In vivo, nothing works: food animal limitations re antibiotics
    – Rifampin with tetracycline was useful in early infection
      » Senturk and Temizel, 2006. Veterinary Record 159(7): 216-217
Non-spore former, but environmentally stable

- *C. pseudotuberculosis* wasn’t killed by 4 months in soil samples containing exudate from CL abscesses, and after 11 months in sterilized soil samples (40°F, 72°F, 98°F and ambient conditions)

- *C. pseudotuberculosis* was killed after 3 hours in chlorinated tap water, but could survive up to 70 hours in distilled water.

- Disinfectants: many are effective against CL after thorough cleaning of surfaces. However: *rough surfaces such as wood may be impossible to disinfect*
• Detection:
  – Exposed animals: PLD antibodies
    • Test based on detecting antibodies
    • “Seropositives” carry the bacteria
• Prevention:
  – Vaccines not 100% effective
    • Boosters, accurate records needed
    • Vaccine will NOT cure, only help prevent abscesses
    • Using vaccine creates “seropositives”
  – Testing and culling seropositives: best method
    • But will this work for all farms?
Trial Methods

• SARE Grant: CL in Sheep
  – Visit farm: use farm vet if possible
  – Test sheep: 0 and at least 60 days
    – Initial SHI tests done by Washington State University
  – Report results (farm ID confidential)
  – Consultation
    • Biosecurity
    • Tailor methods to farm type
    • Survey
  – SHI test method developed at UMaine lab in Orono
    • Supports local industry
    • Create easier access to vigilance methods
    • Validate CL-free status for producers
Trial Results

- **Farm types tested**
  - Breeds: Many
  - Products: Fiber, meat, milk
  - Biosecurity: Varied greatly

- **CL status**
  - 8 of 17 had positive animals at first test (47%)
    - 22% of 705 sheep tested at least once were CL+
  - 8 of 9 negative farms stayed negative (1 didn’t retest)
    - *Closed herd and good biosecurity essential*
  - Inability to run test locally interfered with outcome
  - At follow-up, most of the positive farms had culled or isolated positive animals
Biosecurity: example (Farm 2)

- Breeding for fiber and meat:
  Animals may travel off farm: limited or no quarantine
- Tested “home” animals: all neg.
- Tested “returned” animals: 1 pos.
- Retested “home” animals: new positive

Followup: culled all positives, implemented quarantine procedures for returning animals
Biosecurity Example: Isolated Farm

Wide zone of open forest
Closest farm over 500’ away

Risk: Wild animals likely
Biosecurity Example: Farm Layout

Summer:
sheep rotated based on parasite risk

Winter:
sheep housed in plastic barn

Risk: Quarantine area (star) too close to main flock; new disease can spread
Farmer compliance

- All farmers directly contacted said they would cull
  - Follow-through really varied. “Favorites” or great producers were unlikely to be culled.
  - Most were unwilling to replace wooden feeders or other areas where CL transmission likely.
  - Most thought their biosecurity was excellent
  - All were highly concerned and involved in the success of their flocks
  - Some of the 17 farms had camelids; none had goats

Farmers resented “buying” chronic disease

- “Do unto others” was a strong motive
Conclusions

• Prevalence higher than expected
• Does being CL-free add to value?
  – “Caveat emptor”: Selling CL free breeding stock=value
• Other species affected: goats, camelids
  – Be careful of guard animals: need testing, too
• Farm type dictates whether vaccination ok
  – Reluctance to cull is common
  – Vaccination takes away possibility of testing
  – No strategy works longterm without culling
• Biosecurity and determination dictate whether disease-free status is achievable
Outcomes

- Awareness of CL increased
  - Added value of CL-free status
- Biosecurity templates in development
  - Google Earth model may help communications about farm layout and biosecurity
- SHI method now in Orono on a research basis
  - Project continuing studying goat dairies in 2014-5
  - Sheep testing available in 2015 if serum samples can be collected/shipped to UMAHL (no charge for testing)
- Decision Tree: Start by knowing your status
  - Assess the cost of CL-free status for your farm
  - May not work for everyone
Outcomes: Recommendations

• Know the CL status of your flock: retest as needed
• Maintain closed flock/herd with high biosecurity
  – Notify visitors about biosecurity
  – Inform shearers about biosecurity
  – New or returning animals:
    • Don’t immediately mix with “home” flock
      – “nose to nose ≠ quarantine”
    • CL test immediately at entry and prior to release from quarantine (2 mo. later)
      – If positive, cull or sequester positives
        » Retest exposed animals at 2 months: cull if +
        » Keep quarantined until all negative for CL at 2 consecutive tests 2 months apart
New animal to CL- flock: genetics needed?

Is source flock CL+?

Yes: Don’t buy *or* Quarantine and test at entry and 2 mo.

No: Quarantine and test at entry and 2 mo.
Outcomes: Decision Tree

CL+ at end of quarantine?

Yes:
Slaughter or **Sequester**
No shared spaces, feed, water, equipment; AI only (if a ram)

No:
Add to group
Keep CL- via good biosecurity
Impacts

• Stopped CL on several farms
  – Estimated 20% improvement in fiber yields
  – Potentially reduced carcass condemnation

• Outreach to SR vets
  – Free testing may enhance communications
  – Help establish VCPR with farmers

• Farmer-to-farmer:
  – Added value of CL-free stock
  – Building biosecurity awareness

• Students:
  – projects and experience
Recent Undergrad Student Theses on SR

- Edith Kershner: Case study of sheep farms with or without CL.
- Abigail Royer: Detecting CL using complete blood counts.
- Amy Fish: Evaluating macrophage responses to CL.
- Rachel Chase: Evaluating neutrophil responses to CL.
- Cassandra Karcs: CL prevention in small ruminants.
- Hallie Lipinski: CL and its connection to milk.
- Anna Desmarais: Selenium and footrot prevalence.
- Alden West: Composting effects on coccidia.
- Alexandra Settele: Anthelmintic resistance in *H. contortus*
- Amanda Chaney: Identification of internal parasites of sheep and goats
- Caitlin Minutolo: Effect of age on susceptibility to ovine footrot.
- Nicole Maher: CL webinar for producers
- Casey Athanas: Pedigree analysis to help eradicate footrot.
- Katrina Glaude: Should sheep with footrot be culled?
- Kayla Porcelli: Biosecurity survey for footrot positive farms
- Marie Smith: Pasture management to control parasites in small ruminants.
References

  - Augustine JL and Renshaw HW. Longevity of *C. pseudotuberculosis* in six Texas soils. P 102
  - Augustine JL, Richards AB, Renshaw HW. Persistence of *C. pseudotuberculosis* in water from various sources. P 104.


- Baird GJ, Malone FE. Control of caseous lymphadenitis in six sheep flocks using clinical examination and regular ELISA testing. The Veterinary Record 2010;166:358-362.

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