Early detection of bovine respiratory disease (BRD) in feedlot cattle: why and how?

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Introduction

- Heifer, 28 days after arrival (i.e. days on feed)
- Found dead in pen, treated once the day before
Fatal fibrinous pneumonia (*M. haemolytica*)

Detected and treated too late!
2. How to early detect BRD?
Why early detect BRD?

Early BRD detection → Early antibiotic treatment in the disease process

- Avoid irreversible pulmonary lesions
- Prevent emergence of antibiotic resistances
- Maximize antibiotic action

- Maximize clinical and bacterial cure
- Limit BRD impact on performances
Why early detect BRD?

Mannheimia haemolytica
Pasteurella multocida
Mycoplasma Bovis
Histophilus somni

(Griffin et al., 2010)
Viral infection, stress and/or suboptimal environment

Proliferation of bacteria in the nasopharynx

Bacteria gain access to the lung via aerosolized droplets

Adherence, colonization and replication in the lung

Tissue destruction and inflammation

Bacterial pleuro/broncho-pneumonia
Why early detect BRD?

Evolution of the disease process

When bacteria colonize and replicate:

1) Secretion of enzymes and toxins
   Lipopolysaccharide (LPS), Leukotoxins (LKT), Lipoolysaccharide (LOS), etc.

   Lung damage
   Inflammation

   Inflammation can lead to tissue damage

(Panciera et al., 2010)
When bacteria replicate:

2) Emergence of bacterial resistances

Total bacterial population > mutational frequency to resistance ($10^{-6}$ to $10^{-8}$) => Presence of resistant population very likely (before any treatment)
When bacteria replicate:

2) Larger bacterial inoculum

(Ferran et al., 2011)

Higher dose of antibiotic required to eradicate the bacterial inoculum
Why early detect BRD?

When pulmonary lesions and atelectasia => reduced antibiotic distribution

Early treatment = few (or no) obstructions ➔ Increased antibiotic action
A study by Ferran et al. (2011) investigated experimental lung infection caused by *P. multocida*. They compared three groups: a control group, an early treatment group, and a late treatment group. The early treatment group received antibiotic treatment 10 hours post-infection, while the late treatment group received treatment 32 hours post-infection. Euthanasia was performed 48 hours post-infection for both early and late treatment groups, and 70 hours post-infection for the control group. The question posed is: Why early detect BRD?
Why early detect BRD?

Control group

Late treatment group

Early treatment group

% of mice with *P. multocida* 93% (26/28) 36% (5/14) 0% (0/14)

Early antibiotic treatment:

→ Better bacterial and clinical outcomes

→ Less frequent selection of resistant bacteria
Why early detect BRD?

“Early” BRD treatment
30 young bulls
BRD detection:
Use of rumen temperature boluses
Cefquinom 2.5 mg/kg once

Study design

“Late” BRD treatment
30 young bulls
BRD detection:
Distant examination if BRD signs: rectal temperature
Cefquinom 2.5 mg/kg twice

Preliminary results (30 YB in each group)

Treated animals: 22
Relapse: 6 (27%)
Global antibiotic consumption: 22*2.5 mg/Kg = 55 mg/Kg

Treated animals: 13
Relapse: 4 (30%)
Global antibiotic consumption: 26*2.5 mg/Kg = 65 mg/Kg
Why early detect BRD?

In summary:

- To avoid irreversible pulmonary lesions
- To prevent emergence of antibiotic resistances
- To maximize antibiotic action

- Maximize clinical and bacterial cure
- Limit BRD impact on performances
Outline

1. Why is an early detection of BRD crucial?
How to early detect BRD?

- How are cattle with BRD detected?
  - Distant examination
    - Owner and/or staff
    - Once or twice daily
  - Detection of clinical signs
    - Depression
    - Anorexia/dysorexia
    - Increased respiratory rate
    - Lacrimal and nasal discharges, cough, etc.

(Duff & Gaylean, 2006)
How to early detect BRD?

• Does distant examination enable an early BRD detection?  Answer: No
How to early detect BRD?

Solution: By using automatic health-monitoring systems

A) Changes in body temperature
\( \Rightarrow \) rumen \( T^\circ C \) boluses, IRT, ear mounted thermometers

B) Changes in feeding behavior
\( \Rightarrow \) Growsafe system, ENGS system

C) Changes in physical activity
\( \Rightarrow \) pedometers, accelerometers
How to early detect BRD?

A) Monitoring body temperature to early detect BRD

Fever occurs very early in the disease process (within hours)

Experimental infection of 3 heifers (181±19 kg) with *M. haemolytica* (-21 h)
A) Monitoring body temperature to early detect BRD

BRD affected animals detected 12 to 177 h (mean = 51h) prior to BRD treatment
A) Monitoring body temperature to early detect BRD

BRD affected animals detected 4 to 6 days prior to the onset of clinical symptoms of BRD
How to early detect BRD?

A) Monitoring body temperature to early detect BRD

Promising tools → Cheap <15€

But low sensitivity (21/46 = 46%)

- Inadequate probe placement
- Probe displacement
- High threshold for activation

New version with adjustable probe size and activation threshold

“How Fever Alert” distributed by Merck Animal Health (France) need to be evaluated
How to early detect BRD?

Solution: By using automatic health-monitoring systems

B) Changes in feeding behavior

=> Growsafe system, ENGS system
How to early detect BRD?

B) Monitoring feeding behavior

Diseased feedlot cattle spent on average 30% less time at the feed bunk than healthy cattle (46 min/day versus 60 min/day)
B) Monitoring feeding behavior

Decreased frequency and duration of feed bunk visit

⇒ Detected as sick by the Cusum test

Diseased cattle detected on average 4.1 days earlier than pen checker
How to early detect BRD?

Solution: By using automatic health-monitoring systems

A) Changes in body temperature
- rumen T° C
- boluses, IRT, ear mounted thermometers

B) Changes in feeding behavior
- Growsafe, ENGS system

C) Changes in physical activity
- pedometers, accelerometers

Yes
How to early detect BRD?

C) Monitoring physical activity

Experimental infection of 14 steers (199 kg) with *M. haemolytica*

*M. Haemolytica* infection

Study of Hanzlicek et al. (2010)
C) Monitoring physical activity

Experimental infection of 20 Holstein calves (5-9 week old) with *M. bovis*
How to early detect BRD?

Solution: By using automatic health-monitoring systems

- Changes in body temperature: rumen T° C boluses, IRT, ear mounted thermometers
- Changes in feeding behavior: Growsafe, ENGS system
- Changes in physical activity: pedometers, accelerometers

Yes Yes Yes
• Why are health-monitoring systems not currently used in feedlots?

1st explanation = costs $$$
  • Rumen temperature bolus = $35-100
  • Infrared camera = $7000
  • Growsafe system = $25 per head
  
  Costs are decreasing rapidly!

2nd explanation = low specificity!
  • Numerous “false-positive” detection
How to early detect BRD?

- Lack of specificity of fever and abnormal feeding behavior:

1) Study of Timsit et al. (2011b)
   - Up to 75% of the fever episode detected by rumen T°C bolus lasted less than 47 hours without any treatment
     => viral infection only? Successful immune response? Hyperthermia? Vaccination?

2) Study of Wolfger et al. (2012)
   - Pulling cattle only based on abnormal feeding behavior during the first weeks on feed could lead to pull as much as 90% of the healthy animals
     => Adaptation to the bunk?

How can the specificity of fever and anorexia/dysorexia be improved?
How to early detect BRD?

- How to improve specificity of fever?
  - by taking into consideration the duration of fever

75% of fever episodes lasting longer than 48 hrs led to clinical BRD

48 hrs was also proposed by Radostits et al., 2010

(Timsit and Assié, personal communication)
How to early detect BRD?

- How to improve specificity of fever and abnormal feeding behavior?
  - by combining this parameters (i.e. series testing)

Pull and treat only cattle having concomitantly fever and anorexia/dysorexia
Objective

- To describe the changes in body temperature, feeding behavior and physical activity associated with BRD

Materials and methods

- 560 steers studied during first 50 DOF
- Simultaneous monitoring of body temperature, feeding behavior and physical activity
How to early detect BRD?

Preliminary data (n = 12 sick animals)

- Fever (n =12): onset = 2 to 9 d before detection/treatment; med = 4 d
- Anorexia/dysorexia (n = 9): onset = 0 to 3 d after fever; med = 2 d
- Decreased activity (n =8): onset = 0 to 3 d after fever; med = 2 d
Take home message

- Early BRD detection *i)* limits impact of BRD on performance, *ii)* maximizes clinical and bacterial cure and *iii)* reduces emergence of bacterial resistances

- Distant examination alone cannot enable an early BRD detection

- Health monitoring systems can enable an early BRD detection but further research is needed and is performed already!
Thank you very much for your attention!

Source: Dr. Eugene Janzen
Literature cited

- McCorkell et al. 2014. Limited efficacy of Fever Tag® temperature sensing ear tags in calves with naturally occurring Bovine Respiratory Disease or induced Bovine Viral Diarrhea Virus infection. Can Vet J. Accepted.