Toxicology Update For Veterinarians

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Outline

- Multiple cases of chondrodysplasia and dwarfism in calves

- Lead reminder

- Water source awareness
  - Nitrate & urea poisoning
Multiple cases of chondrodysplasia & dwarfism in beef calves
Index Case: Steamboat Rock, IA

- 9 of 12 first calf heifers have given birth to non-viable dwarf calves
  - Calves from mature cows unaffected

- Gross necropsy
  - Enlarged epiphyses in all long bones of the limbs
  - Shortened diaphyses
  - Shortened overall bone/limb length (Femur: ~30% normal length)
## Additional Cases

<table>
<thead>
<tr>
<th>Case #</th>
<th>Location (IA)</th>
<th>Date</th>
<th># Affected</th>
<th>Lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Maynard</td>
<td>3-11-19</td>
<td>93 (50%)</td>
<td>Limb deformities (Enlarged joints, crooked legs) Shortened legs “Bulldog” heads (30%)</td>
</tr>
<tr>
<td>3</td>
<td>Postville</td>
<td>Within the same timeframe as others</td>
<td></td>
<td>Consistent with other cases</td>
</tr>
<tr>
<td>4</td>
<td>Muscatine</td>
<td></td>
<td>Multiple</td>
<td>Consistent with other cases</td>
</tr>
<tr>
<td>5</td>
<td>Audubon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Riceville</td>
<td>3-20-19</td>
<td>3</td>
<td>Joint laxity Enlarged joints Shortened legs</td>
</tr>
<tr>
<td>7</td>
<td>Clarksville</td>
<td>3-22-19</td>
<td>1</td>
<td>Shortened abnormal legs</td>
</tr>
<tr>
<td>8</td>
<td>Cherokee</td>
<td>3-26-19</td>
<td>6</td>
<td>Enlarged joints and short legs</td>
</tr>
</tbody>
</table>

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2019
# Additional Cases

<table>
<thead>
<tr>
<th>Case #</th>
<th>Location (IA)</th>
<th>Date</th>
<th># Affected</th>
<th>Lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maynard</td>
<td>2-26-20</td>
<td>4</td>
<td>Limb deformities (Enlarged joints)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Legs folded underneath</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shortened legs</td>
</tr>
<tr>
<td>2</td>
<td>Cherokee</td>
<td>3-2-20</td>
<td>2-4</td>
<td>Joint laxity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Enlarged joints</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shortened legs</td>
</tr>
<tr>
<td>3</td>
<td>Dyersville</td>
<td>3-20-20</td>
<td>4</td>
<td>Shortened abnormal legs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Enlarged joints</td>
</tr>
<tr>
<td>4</td>
<td>Griswold</td>
<td>5-21-20</td>
<td>7</td>
<td>Enlarged joints</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Severely shortened legs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Domed head</td>
</tr>
</tbody>
</table>
Newborn Calf (April 2019)
Dwarf Calves
Physis: One day old unaffected calf

Reserve zone

Proliferative zone

Hypertrophic zone
Case 2
Ancillary Testing

• BVD – Negative on all submitted cases

• Trace mineral analysis (Liver)
  • Manganese – Below reference range
    • Whole blood - Low
  • Zinc – Below reference range (1 sample)

• Genetic testing
  • Not performed at ISU VDL
  • Independent genetic testing by clinics
  • Genetic variability reported among calves
Investigation into Affected Sites

Questionnaire Focus

- Herd history
  - Breed
  - Recent introductions
  - Management practices

- Past history of:
  - Reproductive failure
  - Congenital defects
  - Infectious disease

- Gross lesions/clinical description

- Ration during the entire length of gestation
  - Ration components
  - Mineral supplementation

- Number of affected calves vs total herd size

- Characteristics of the dams of affected and unaffected calves
  - Sire information

- Environment during the entire length of gestation
  - Pasture vs dry lot vs mixed
  - Teratogenic plant exposure

- Treatment
Commonalities Between Sites

• Pastures became poor in October (45+ Days earlier than usual)
  • Cattle were moved to dry lot and fed rations with high amounts of corn silage

• Most severely affected site
  • Group of heifers that stayed on a different pasture 45 days longer → 0 affected calves

• High percentage of ration was corn silage
  • Only feedstuff in majority of cases

• All sites - Free choice mineral offered
Differentials

• In utero viral infection
  • BVD not detected in submitted cases
  • Can’t be ruled out in other cases

• Genetic
  • Unlikely – Varied genetics between herds, different sires, different breeds
  • Purebred angus herd – Different sires each of 3 years

• Poor general nutrition?
  • Drought
  • High amounts of silage
  • Manganese deficiency
Differentials

• Manganese deficiency
  • Cofactor in enzymatic pathways for glycosaminoglycan and collagen synthesis
  • 2016-2019: 47% of trace mineral panels on bovine liver have been below reference range (2.5-6.0ppm)
  • Cases of chondrodysplasia tended to have very low manganese levels
    • Current case series: 0.8ppm, 1.0ppm, 1.1ppm
    • Previous cases at ISU-VDL: 0.6ppm

• Previous research reproduced disproportionate dwarfs/brachygnathia
Differentials

• Role of increased duration/amount of corn silage
  • Grasses have higher concentrations of manganese; Straw and corn silage can have relatively low concentrations; 92% of corn silage samples contained Mn levels below requirement

• Rations high in ensiled components as the sole overwinter feed associated with disproportionate dwarfism/joint laxity

• Iron and other compounds may decrease manganese bioavailability
Case 6: 2 Month Follow-up Student Visit
Case 6: Affected Yearling w/ Age Matched Controls
2019 Follow-Up

• No reported cases sites affected in 2019

• Mineral either supplemented through TMR or injection

• Questionnaires planned to be sent out for additional information
Lead Reminder
Common Sources

- **Lead batteries** (~60% lead)
  - Discarded fence line batteries → freeze → crack → lead plates exposed
  - Junk piles
  - Old automobiles

- Crankcase oil

- Grease containers

- Building foundations
Clinical Signs

• **Neurologic (CNS)**
  - Blindness
  - ↑ vocalization
  - Ataxia
  - Head pressing
  - Tremoring & Convulsions
  - Bruxism
  - Circling
  - Aimless wandering
  - Found dead

• **Gastrointestinal**
  - Anorexia
  - Rumen stasis
  - Gaunt

*May not observe GI signs*
Sample Collection & Diagnostic Testing

- Ante mortem
  - Whole blood
  - Milk

- Post mortem
  - Liver
  - Kidney
  - Bone
  - GI Ct
  - Brain

- Other
  - Unknowns
  - Feed

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Prevention
- Evaluate the environment
- Unexpected finds
- Remove or isolate potential sources

Brain alone can’t Dx lead poisoning
Water Source Awareness

Nitrate & Urea Poisoning
Causes of Intoxication 2019 & 2020

• Nitrate / Urea based fertilizers
  • Application on forages

• Water
  • Heavy rains immediately after application

• Fertilizer tanks used for water
  • Tanks reported to have been washed (Multiple Times)
Clinical Signs

• Found dead
  • Acute death

• Ataxia and tremors

• Urea
  • Prostration
  • ↑ Urination
  • Frothing at mouth
  • Diarrhea

• Nitrate
  • Brown / Chocolate blood
  • Muddy mucous membranes
  • Respiratory distress
Sample Collection & Testing

- Biological Samples
  - Ocular fluid
    - Serum
    - Rumen content
    - Rumen pH

Collect, seal, & freeze samples **ASAP** following death
Urease enzyme remains active even after death
Acidification of rumen

>12 hours (moderate climate)
Too much autolysis has occurred \(\rightarrow\) ↓ diagnostic value

- Feed, Forage, Supplement
  - ½ gallon bag
- Water
  - 250 ml
Prevention

• Do **not** provide water in tanks used for fertilizer
  • Washed out or not

• Use a new tank / designated water tank

• Be aware of fertilizer applications and heavy rains

• Eliminate exposure to suspected sources
Questions?

To ask questions, type into the Q&A or Chat. To find these options, hover your mouse over the screen and click on the chat or question icon. If not visible, click bubble with three dots and select Q&A.

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