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 3/6/19

- 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

2019

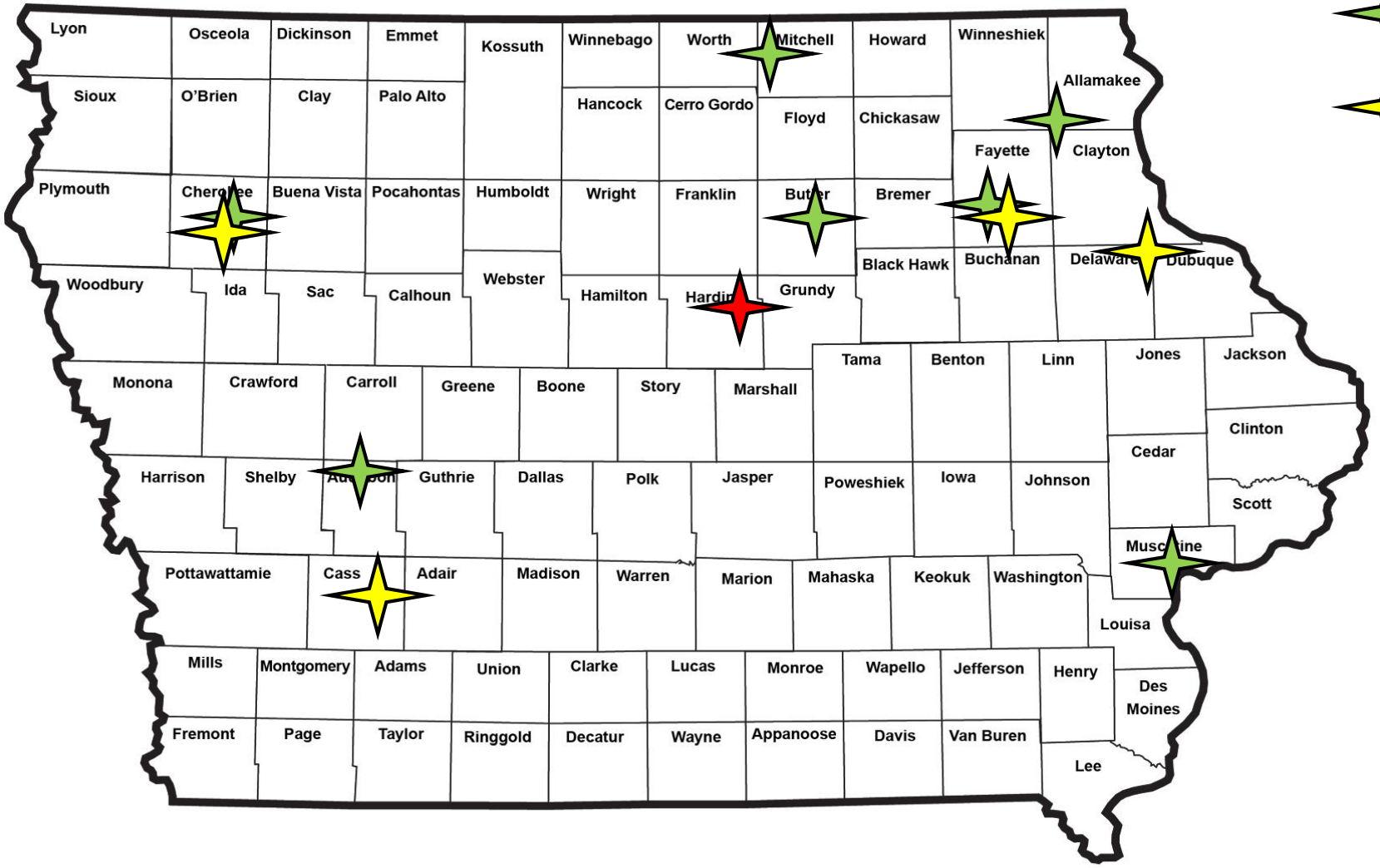
Case #	Location (IA)	Date	# Affected	Lesions
2	Maynard	3-11-19	93 (50%)	Limb deformities (Enlarged joints, crooked legs) Shortened legs “Bulldog” heads (30%)
3	Postville	Within the same timeframe as others	Multiple	Consistent with other cases
4	Muscatine			
5	Audubon			
6	Riceville	3-20-19	3	Joint laxity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

Additional Cases

2020

Case #	Location (IA)	Date	# Affected	Lesions
1	Maynard	2-26-20	4	Limb deformities (Enlarged joints) Legs folded underneath Shortened legs
2	Cherokee	3-2-20	2-4	Joint laxity Enlarged joints Shortened legs
3	Dyersville	3-20-20	4	Shortened abnormal legs Enlarged joints
4	Griswold	5-21-20	7	Enlarged joints Severely shortened legs Domed head

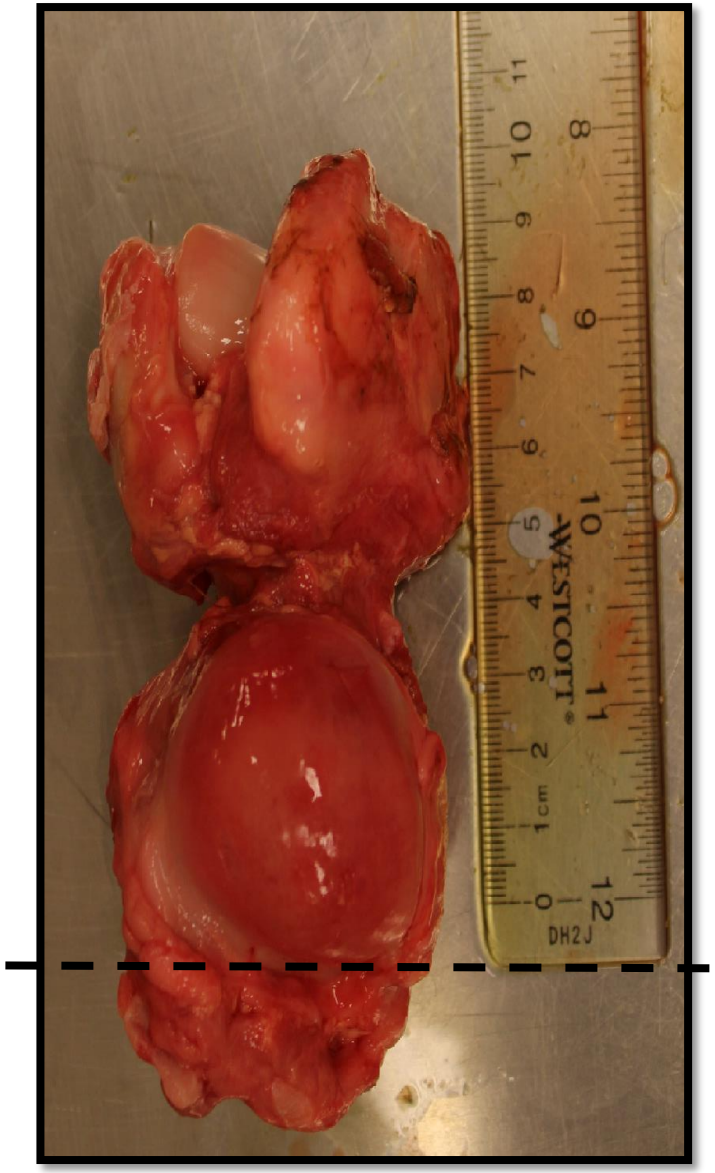
Additional case locations



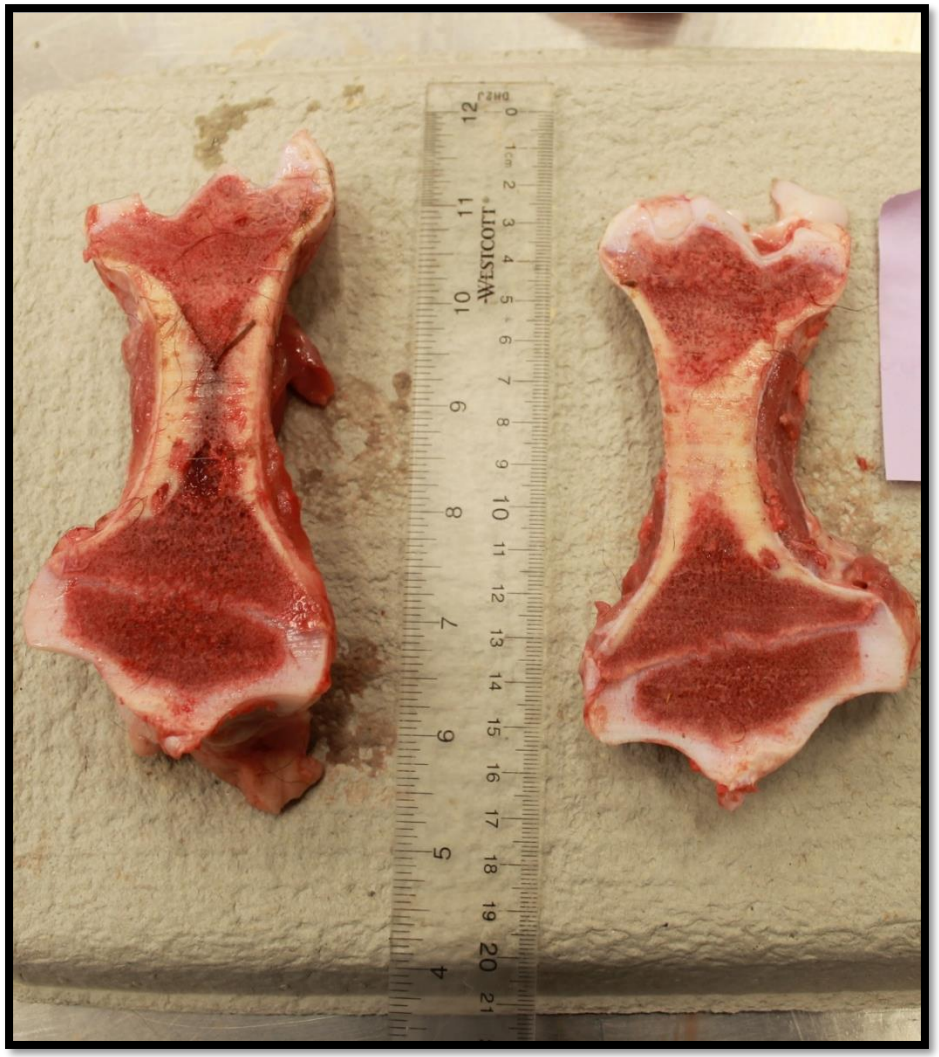
Newborn Calf (April 2019)

Dwarf Calves

Dwarf Calves



Humerus

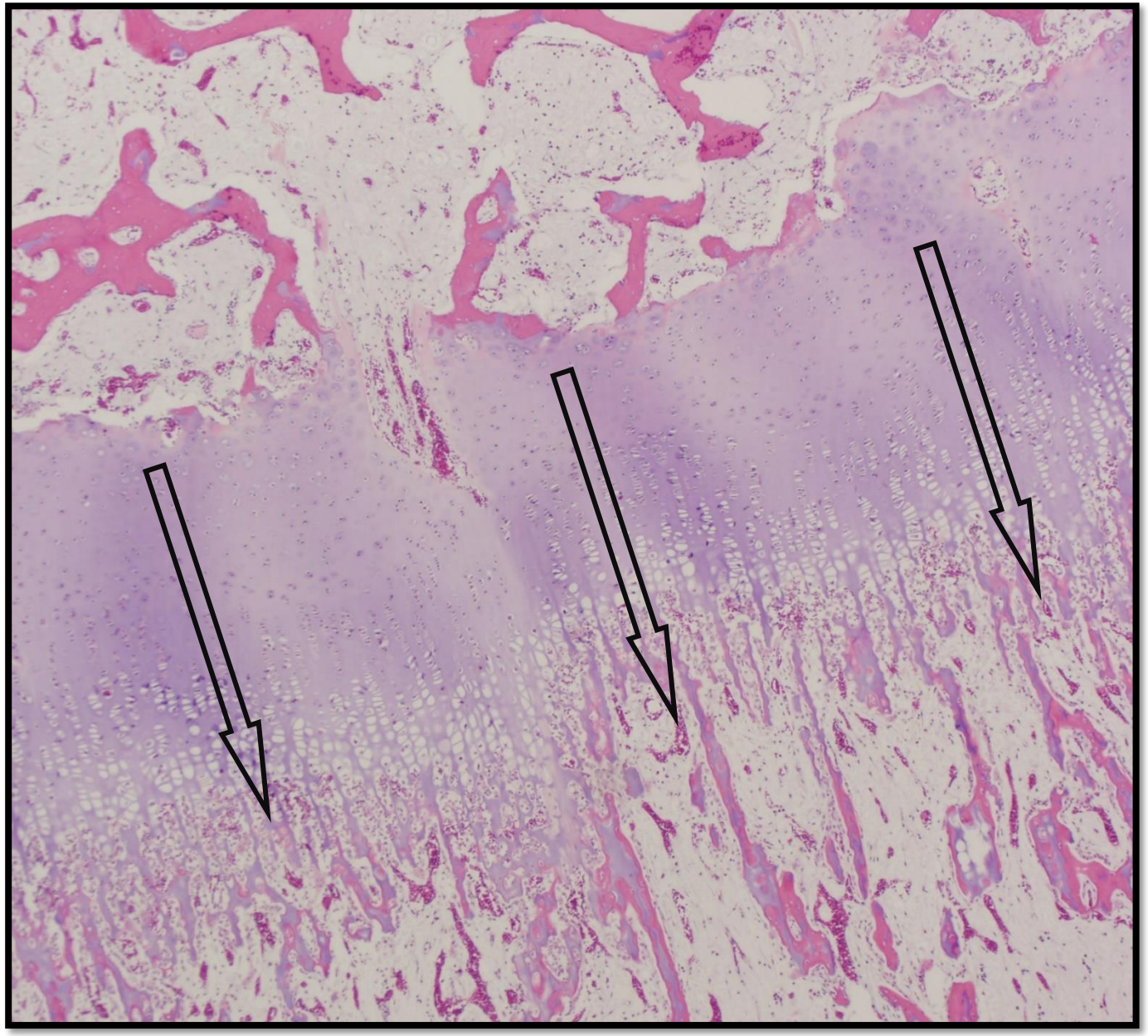


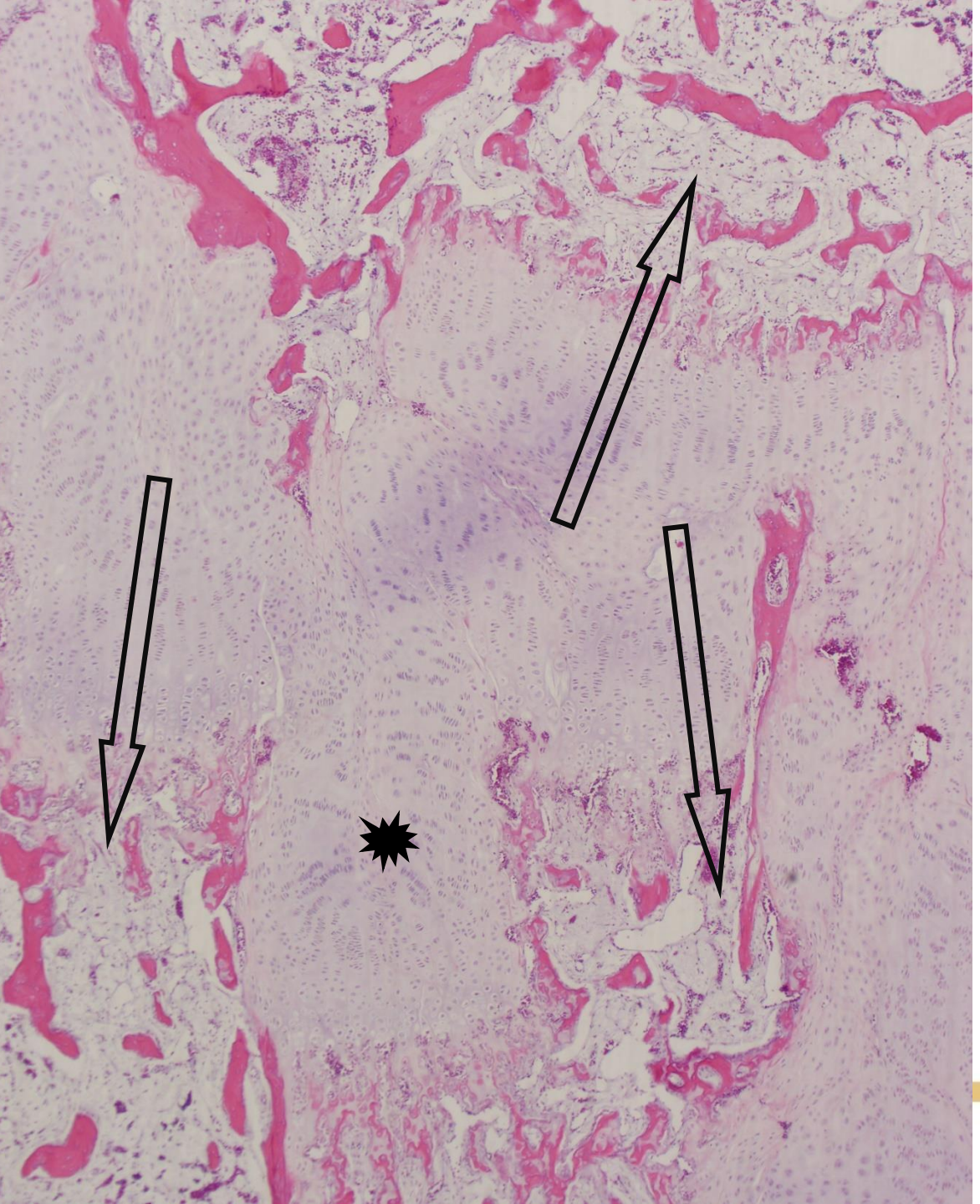
Physis: One day old unaffected calf

Reserve zone

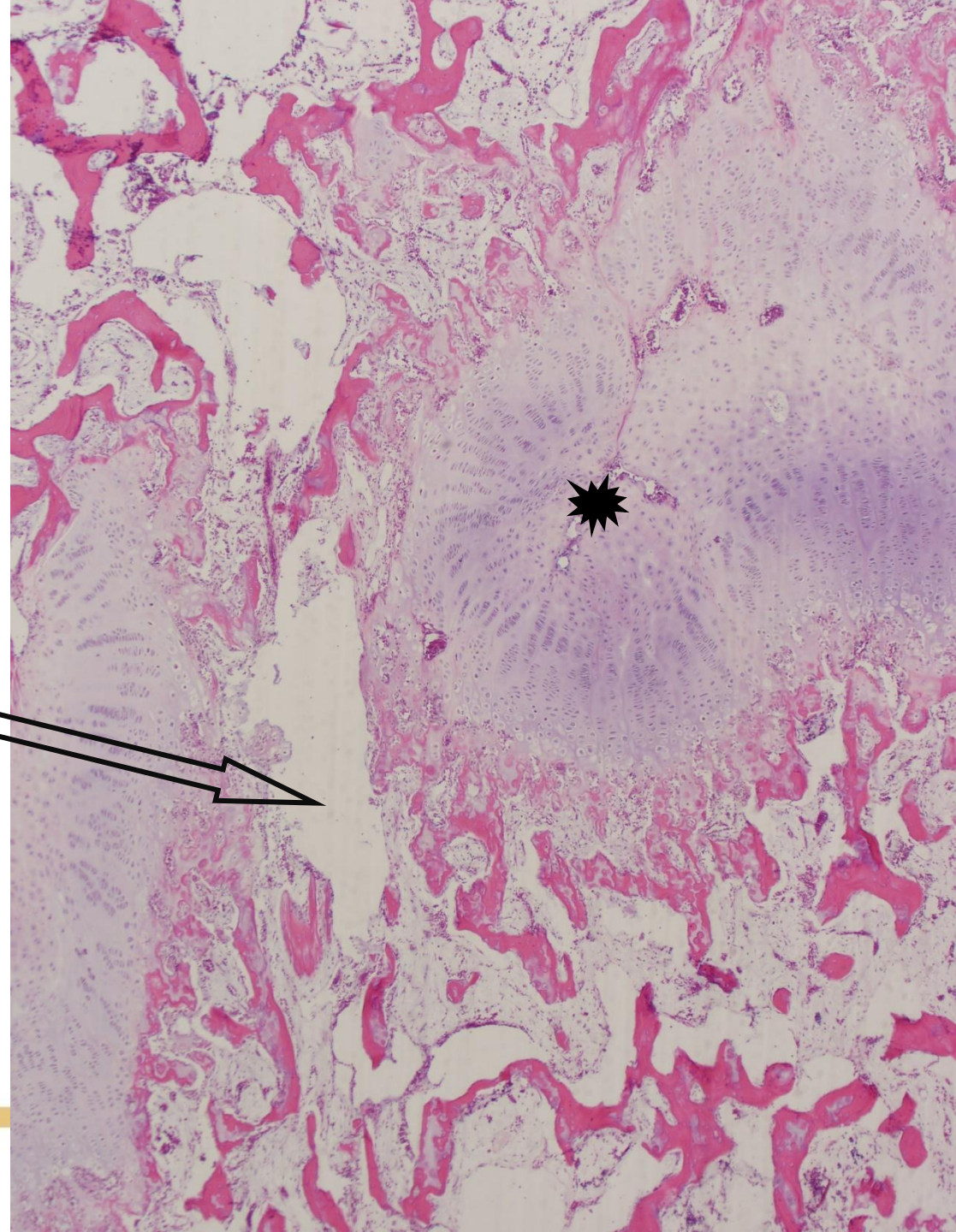
Proliferative zone

Hypertrophic zone

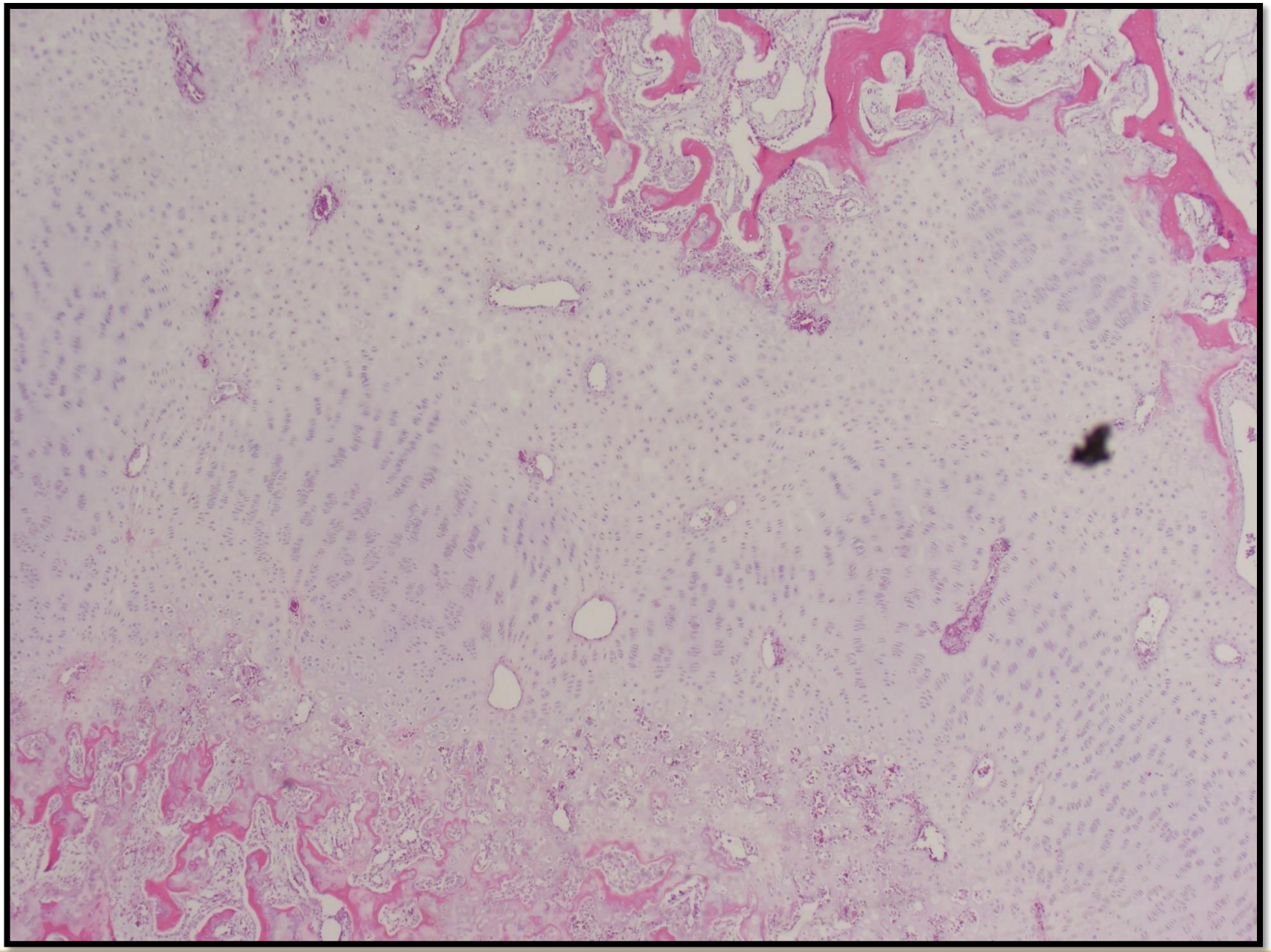




Case 1



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
  - Hansen, et al. Feeding a low manganese diet to heifers during gestation impairs fetal growth and development. 2006. Journal of Dairy Science. 89:4305-4311

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
    - Hidiroglou. 1979. Manganese in ruminant nutrition. Canadian journal of animal science. 59:217-236.
  - Rations high in ensiled components as the sole overwinter feed associated with disproportionate dwarfism/joint laxity
    - Ribble, et al. 1989. Congenital joint laxity and dwarfism: A feed-associated congenital anomaly of beef calves in Canada. Canadian Veterinary Journal. 30:331-338.
- Iron and other compounds may decrease manganese bioavailability

Case 8: Calf from Video (July 2019)

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

Lead Testing

Histopath

Brain alone can't Dx lead poisoning

Prevention

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

Water Source Awareness

Nitrate & Urea Poisoning

Causes of Intoxication 2019 & 2020

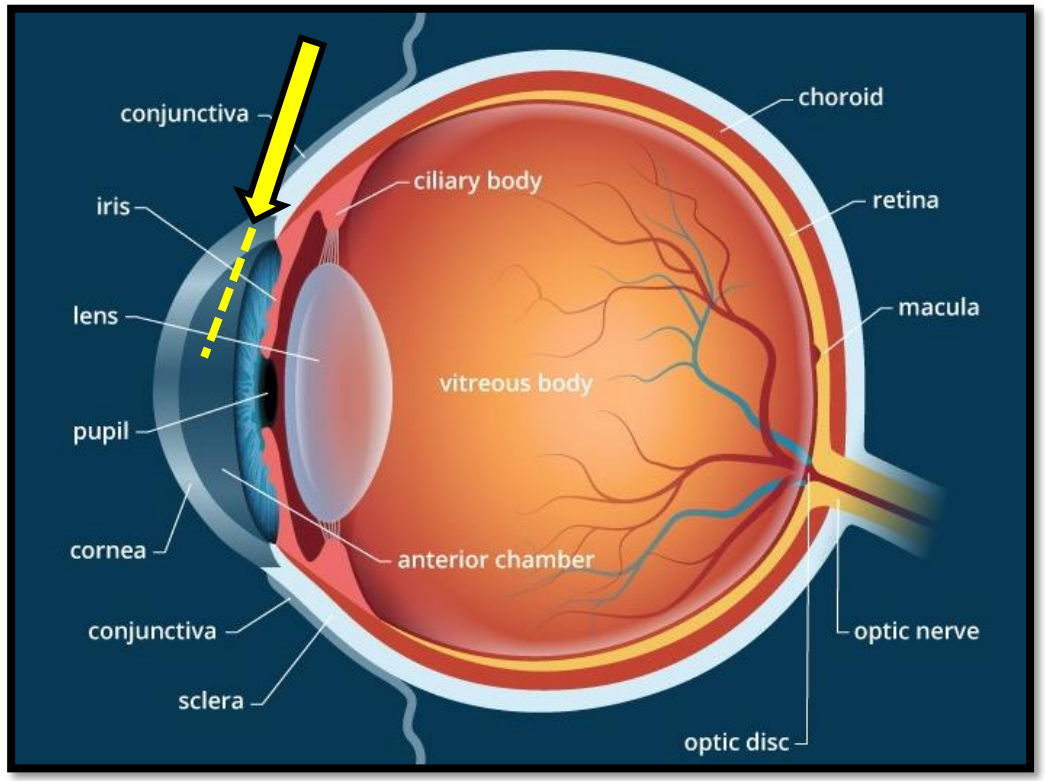
- Nitrate / Urea based fertilizers
  - Application on forages
- Water
  - Heavy rains immediately after application
  - Fertilizer tanks used for water
    - Tanks reported to have been washed **(Multiple Times)**

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 → ↓ 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?

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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