Please Note: This Case Summary was submitted in 2024, when a Discussion section was not required. All 2025 case summary submissions MUST include a Discussion section.

Perilla Mint Intoxication in a 5-year-old Angus Cow

Introduction

Perilla frutescens is known in the United States as perilla mint, rattlesnake weed, and beefsteak plant. Originating in Eastern Asia, it has been distributed throughout the Midwestern, Eastern, and Southern United States. An annual plant, it can be one of the few robust and green plants in an overgrazed or fall pasture. Cattle don't typically consume this plant but in times of inadequate feed sources.

Perilla mint contains ketones that, when activated by pulmonary microsomal enzymes, cause acute respiratory distress and atypical interstitial pneumonia.[1,2] Atypical, or acute, interstitial pneumonia may be referred to as acute bovine pulmonary edema and emphysema. Cattle may develop signs from consuming any part of the plant although the seed has higher toxicity.[3] Affected animals can become aggressive from hypoxia or acutely die. Postmortem exam may reveal heavy, firm, non-collapsable lungs along with froth within the airways. Type II pneumocyte proliferation may be seen in these cases which prevent lung tissue collapse.[3] Clinical signs can appear within twenty-four hours of ingestion, with the severity dependent on the volume ingested. Cattle are most often affected although all large animal species are susceptible.

Atypical interstitial pneumonia differential diagnoses in cattle include parasitic pneumonia, lung perforation by traumatic reticuloperitonitis, pulmonary abscessation, other plant intoxication such as by *Senecio quadridentatus*, and fungal intoxication by *Periconia* species.[2]

In this case, the diagnostic approach focused on ruling out other causes of the respiratory signs, including working up the possibility of lungworm infection given the herd necropsy history, and looking for environmental or nutritional causes given the herd mortality pattern.

Treatment/Management/Prognosis

Treatment for perilla mint intoxication involves removing the cow from plant access, providing anti-inflammatories, maintaining a low-stress environment, and monitoring for secondary causes of pneumonia. Pasture treatment requires post-emergence herbicide application before the plant's seeding. While clinical signs often develop in the fall, it isn't often efficacious to spray affected pastures until the following spring or summer. The plant is toxic even when dried as hay containing this plant can also lead to clinical signs. Proper pasture management to prevent overgrazing and thus room for weeds to flourish is important as fencing off affected pasture and preventing seed dispersal is often unrealistic.

Supportive care may include fluid administration, acid-base management (from the hypoxemia or ptyalism), nutritional and electrolyte support should an animal not be willing or able to eat, antimicrobials should secondary bacterial pneumonia develop, and in severe cases, oxygen administration and nebulization.

If an animal survives the first forty-eight hours of clinical disease with no further ingestion, recovery typically occurs. As with other pneumonia cases, lasting pulmonary damage may result.

Case history and presentation

A 5-year-old Angus cow presented on October 3, 2023, for acute respiratory distress. This was the fifth cow in six years to develop these fall respiratory signs. The four previous cows had died within a few days of clinical onset. Calves had always been sold prior to clinical signs developing in the herd. Two of the four cows were submitted to a diagnostic lab for necropsy, with one being diagnosed with fibrinosuppurative bronchopneumonia and subcutaneous emphysema with suspected intrapulmonary parasitism due to hemorrhagic tracks present. Lung

culture and molecular diagnostics were negative for all major causes of the bovine respiratory disease complex. No diagnosis was found on the other necropsy. The owner had tried treating one of the previously affected, non-necropsied cows with a combination florfenicol (40 mg/kg) and flunixin meglumine (2.2 mg/kg) injectable[a] subcutaneously with no response seen. The herd consists of 29 cows on 80 acres. This cow was artificially inseminated on April 1, 2023 and previously confirmed to be pregnant. The herd calves in January, and the cows are administered a modified live, viral, respiratory disease vaccine[b] and eprinomectin[c] in the spring and a vibriosis and leptospirosis vaccine[d] in the fall. The herd receives a mineral injection[e] twice annually.

The cattle are kept on pasture from May through December. Every 30-45 days, they rotate from one half of the pasture to the other before the fescue stems dry out and go to seed on the other side. From January through April, they are supplemented with grass hay, corn, and bean meal. A non-complete mineral source[f] is available year-round. From April through June, they also receive a high magnesium complete mineral. The owner feeds them 10-15 gallons of corn tortilla dough balls daily from a plant nearby to bring them up from pasture for an evening check. The presenting cow was found to have respiratory signs on October 3rd during this check and was brought in on emergency with no prior treatments administered.

On presentation, this cow was aggressive, limiting initial workup. She had a 6.5/9.0 body condition score, weighed 630 kgs, was pyrexic with a rectal temperature of 105 F, stood with her neck outstretched, and exhibited open mouth breathing with ptyalism and tongue protrusion. She was placed in a stall overnight and was administered 1 mg/kg of meloxicam[g] tablets orally in a scoop of cattle grain which she consumed. She was offered free-choice grass hay and water throughout hospitalization. Within an hour of hospitalization, she was no longer continuously

open mouth breathing and had a respiratory rate of 40 breaths per minute. Whenever she noticed people, the ptyalism and abnormal respiratory signs redeveloped.

Case management and outcome

The next morning, a full exam and diagnostic work-up were performed. She still exhibited pyrexia (104.5 F rectal temperature), but her heart rate was within normal limits (76 beats per minute). Rumen contractions were decreased in rate and strength (two rumen contractions per two minutes). Her resting respiratory rate in her stall was within normal limits (40 breaths per minute) but increased to 100 breaths per minute in the chute. Her lung sounds were within normal limits on auscultation of all lung fields, and she had no increased tracheal sounds. Thoracic ultrasound revealed rare B lines in the cranioventral lung fields bilaterally with no other abnormalities seen (Figure 1). She exhibited open mouth breathing and ptyalism intermittently throughout the exam but didn't appear to have increased respiratory effort. Full bloodwork was submitted to assess hydration and electrolyte status, acid-base status, and changes to her major organs given the potential of intoxication given the herd motality pattern. Results showed probable stress hyperglycemia, azotemia, hypophosphatemia, hypokalemia, hyperproteinemia characterized by hyperglobulinemia, and elevated AST and CK (Table 1). It was suspected that the azotemia and elevated AST and CK were secondary to poor oxygenation of tissues from the severe respiratory distress at presentation. However, given the behavior of this cow, it was opted after discussion with the owner to avoid oxygen administration and practice infrequent and calm handling. The hyperglobulinemia was antigenic stimulation secondary to the suspected pneumonia. The hypokalemia could be from glucosuria causing diuresis or hyporexia. The hypophosphatemia was suspected to be from the hyporexia and

salivary loss through ptyalism although insulin release in response to the hyperglycemia or diuresis from the hyperglycemia could contribute.

She was sedated with 4 ug/kg detomidine[h] intramuscularly due to adverse behavior in the chute and given fifteen minutes before further workup. Rectal palpation was performed, and pregnancy was confirmed consistent with six months in gestation with no abnormalities on rectal exam. Both a Baermann fecal sedimentation and quantitative fecal were submitted given the history of a herd mate having suspected intrapulmonary parasitism and given that no fecals had been performed in this herd in the past, and the owner was curious of her status (Table 2). No lungworm infestation was diagnosed, nor any significant internal parasite burdens to be causing immunosuppression. Given this cow's aggression and intermittent signs, it was opted to submit a deep nasopharyngeal swab for a bovine respiratory molecular diagnostics panel and externally palpate the neck and pharyngeal area for abnormalities (none found) rather than performing a deep oral exam and a bronchioalveolar lavage or transtracheal wash (Table 3). There was concern that the restraint needed to do these procedures would place the cow into respiratory distress. In addition, the mild ultrasound findings and the pattern of only individual animals in the herd showing signs was not consistent with bacterial pneumonia. Results of these molecular diagnostics were all negative.

Perilla mint intoxication was introduced in conversation with the owner given the time of year, pattern of mortality in the herd, geographic location, and no obvious explanation for her clinical signs from her exam and diagnostics performed thus far. The owner walked his pasture and was confident that this weed was well distributed throughout.

Given her decreased rumen contractions and inadequate water and feed consumption for her maintenance requirements during the first night of hospitalization, she was transfaunated in

the chute with rumen fluid from a healthy, cannulated donor cow. Approximately fifteen liters of rumen fluid via nasogastric intubation was administered along with fifteen liters of water mixed with a 300 mL tube of supplemental electrolyte gel[i] for her electrolyte abnormalities. Repeat bloodwork later in hospitalization was offered but understandably declined by the owner due to the concern of causing further stress to the cow by additional handling.

Due to this cow's stress level, lack of adequate appetite, and pregnancy status with a valuable fetus, she was only hospitalized for three days. She received 0.5 mg/kg of meloxicam tablets orally in cattle grain 48 hours after the initial dose. She consistently showed improvement in clinical signs and was discharged. Upon follow-up with the owner, she was noted to continue to have intermittent episodes of open-mouth breathing, ptyalism, and tongue protrusion for two days after discharge before recovery. The owner kept her in a stall for two weeks to ensure no abortion or any respiratory signs redeveloped.

An agronomist studied the home pasture during the cow's hospitalization and officially identified the diffuse perilla mint presence. Fencing off the affected areas was not realistic, and the owner didn't want to take the herd off pasture yet to have to feed solely with hay. Given that the plants were already seeding and would be dying soon, the owner opted to wait until late spring to have this agronomist out to spray the pastures with herbicide. In the meantime, he started supplementing hay. No other cattle in this herd developed clinical signs that fall.

Endnotes

[a]Florfenicol and flunixin meglumine, Resflor GOLD, Merck Animal Health, Rahway, New Jersey.

[b]Bovi-Shield GOLD 5, Zoetis, Inc., Kalamazoo, Michigan.

[c]Eprinomectin, LongRange, Boehringer Ingelheim, Duluth, Georgia.

[d]Spirovac VL5, Zoetis, Inc., Kalamazoo, Michigan.

[e]Multimin 90, Axiota, Fort Collins, Colorado.

[f]Availa 4, Zinpro, Eden Prairie, Minnesota.

[g] Meloxicam Tablets, USP, Zydus Pharmaceuticals USA Inc., Pennington, New Jersey.

[h]detomidine, Dormosedan, Zoetis, Inc., Kalamazoo, Michigan.

[i]CMPK gel, Durvet, Inc., Blue Springs, Missouri.

References

[1]Hovda, LR, Garland, T, Puschner, B, et al. Disorders Caused by Toxicants. In: Smith, BP, Van Metre, DC, Pusterla, N, eds. *Large Animal Internal Medicine*. 6th ed. Elsevier, Inc; 2020:1764–1809.

[2]Constable, PD, Hinchcliff, KW, Done, SH, et al. Diseases of the Respiratory System. In: Constable, PD, Hinchcliff, KW, Done, SH, et al, eds. *Veterinary medicine: A textbook of the diseases of cattle, horses, sheep, pigs and goats*. 11th ed. Elsevier, Inc;2017:845–1090.

[3]Casteel, SW, Johnson, PJ. Collapse and Sudden Death. In: Smith, BP, Van Metre, DC, Pusterla, N, eds. *Large Animal Internal Medicine*. 6th ed. Elsevier, Inc; 2020:227-235.

Lab data/Imaging

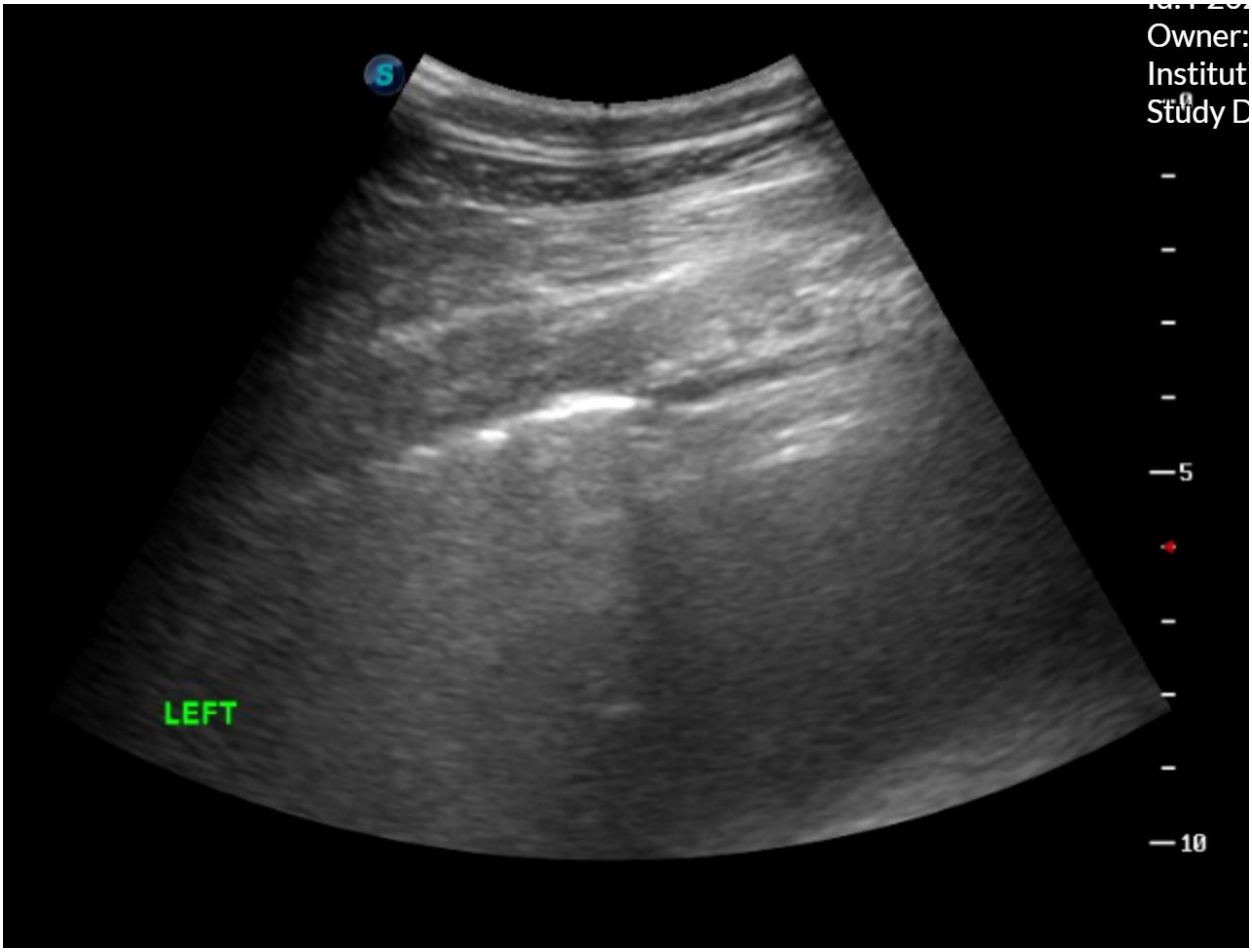

Figure 1: Ultrasound image of the left cranioventral lung field with the probe held in a longitudinal position parallel to the ribs with the cow standing in a chute of a case of suspected perilla mint intoxication

Day of Hospitalization	Results	Reference Ranges
2	Fibrinogen: 281 mg/dL	100-600 mg/dL
	Total Protein (plasma): 8.2 g/dL	7.0-8.5 g/dL
	Red Blood Cell: 6.63 M/uL	6.00-10.00 M/uL
	Hematocrit: 37.7%	30.0-45.0%
	Hemoglobin: 14.2 g/dL	9.0-15.0 g/dL
	MCV: 56.9 fL	38.0-50.0 fL
	MCHC: 37.7 g/dL	34.0-38.0 g/dL
	RDW: 15.3%	23.3-33.6%
	White Blood Cells: 9.1 K/uL	4.0-12.0 K/uL
	Platelet: 293 K/uL	100-800 K/uL
	MPV: 7.5 fL	5.0-8.0 fL
	White Blood Cells: 9.1 K/uL	4.0-12.0 K/uL
	Segmented Neutrophils: 3.9 K/uL	1.0-4.0 K/uL
	Lymphocytes: 4.6 K/uL	2.5-7.5 K/uL

	Monocytes: 0.45 K/uL	0.05-0.80 K/uL
	Eosinophils: 0.09 K/uL	0.10-2.50 K/uL
	Anisocytosis: 1+	
	Platelet: 293 *clumped* K/uL	100-800 K/uL
	Platelet Estimate: Adequate	
	Platelet Comments: Enlarged Platelets Noted	
	Glucose: 127 mg/dL	44-78 mg/dL
	BUN: 12 mg/dL	6-22 mg/dL
	Creatinine: 1.50 mg/dL	0.50-1.10 mg/dL
	Phosphorus: 3.9 mg/dL	4.7-9.0 mg/dL
	Calcium: 9.1 mg/dL	8.2-10.0 mg/dL
	Sodium: 143 mmol/L	134-144 mmol/L
	Potassium: 3.3 mmol/L	4.0-5.7 mmol/L
	Chloride: 104 mmol/L	96-104 mmol/L
	Carbon Dioxide: 21 mmol/L	19-29 mmol/L
	Anion Gap: 21.3 mmol/L	15.0-21.0 mmol/L
	Total Protein: 8.1 g/dL	5.8-7.5 g/dL
	Albumin: 3.3 g/dL	2.4-3.5 g/dL
	Globulin: 4.8 g/dL	3.2-4.4 g/dL
	A/G Ratio: 0.7	0.6-1.1
	AST: 171 IU/L	58-100 IU/L
	ALP: <20 IU/L	41-116 IU/L
	GGT: 37 IU/L	22-64 IU/L
	Creatine Kinase: 3357 IU/L	52-350 IU/L
	Total Bilirubin: 0.60 mg/dL	0.10-0.60 mg/dL
	Magnesium: 2.0 mg/dL	2.0-2.8 mg/dL

Table 1: Complete blood count, serum chemistry, and fibrinogen results from initial workup of a cow with suspected perilla mint intoxication

Day of Hospitalization	Test	Results
2	Fecal Description	Color: brown Consistency: soft Blood: negative Mucus: positive
	Fecal Floatation- Quantitative	Trichostrongyle type eggs: 25 eggs/gram Eimeria spp.: 25 oocysts/gram
	Fecal Larval Exam- Baermann Sedimentation Technique	No parasites seen

Table 2: Quantitative fecal floatation and fecal sedimentation results from feces collected during the initial workup of a cow with suspected perilla mint intoxication

Day of Hospitalization	Organism	Result
2	Bovine Coronavirus	Negative
	Bovine Respiratory Syncytial Virus	Negative

	Bovine Viral Diarrhea	Negative
	Infectious Bovine Rhinotracheitis	Negative
	Mycoplasma bovis	Negative
	Parainfluenza 3	Negative

Table 3: Bovine respiratory PCR panel results from a deep nasopharyngeal swab collected during initial workup of a cow with suspected perilla mint intoxication