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Disease Syndromes in Grazing Ruminants Prevalent During Periods of Prolonged Drought

Dr Rick Last BVSc, MMedVet(Path)
– Specialist Veterinary Pathologist

The diagnostic disease entities known to become apparent in grazing ruminants during periods of drought are closely related to age. The developing foetus, growing and pregnant/lactating animals being most susceptible. Many of the common drought-associated disease conditions are associated with recognisable pathology.

PM investigation of the aborted foetus should include evaluation for:

- In-utero growth retardation (IUGR)
- Thyroid gland goitre
- Thymus gland atrophy
- Hydrocephalus

In-utero growth retardation (IUGR)

Foetal weight, crown-rump length, external foetus characteristics, metatarsal length:width ratio (cattle), placental cotyledon diameter (cattle) or placental cotyledon weight (small ruminants) are used to help determine if foetal/placental growth is within the normal growth curve or indicative of stunted growth. Gross pathological features suggestive of IUGR include short broad heads and bulging forehead, shortening of the maxilla with a protruding mandible, protrusion of basisphenoid bone (due to premature closure of synchondroses), shortening metacarpal bones and growth arrest lines. IUGR has a permanent negative impact on postnatal growth, feed conversion rate, body composition and meat quality.

Thyroid gland goitre

Enlargement of the thyroid gland is a gross pathology that is highly suggestive of metabolic and/or endocrine abnormalities. During periods of fodder shortage, micronutrient imbalances, exposure of the dam to goitrogenic substances or mycotoxins contaminated supplementary feedstuffs are the most common initiators of goitre in the foetus/neonate.

Thymus gland atrophy

Zinc and copper deficiency maybe associated with thymic atrophy. Thymic atrophy is associated with significant immunosuppression and so predisposes to secondary complicating infectious aetiologies, which may deflect the investigation.

Hydrocephalus

Vitamin A deficiency has been associated with hydrocephalus and this is thought to be the consequence of increased cerebrospinal fluid pressure in vitamin A deficient individuals.

PM investigation of lambs/calves/kids* - evaluate for

- Metabolic bone disease
- Nutritional myopathy
- Copper deficiency
- Zinc deficiency
- Vit A deficiency

*rapidly growing animals particularly sensitive to protein, energy, vitamin and mineral deficiencies and/or imbalances.

Metabolic bone diseases

True single micronutrient deficiencies are only seen in the experimental situation. The various micronutrients in bone metabolism and strength are intimately related to one another with interactions between them needing to be in balance. Metabolic bone disease results from imbalances/deficiencies of various micronutrients and includes the pathologies rickets, fibrous osteodystrophy and osteoporosis. Examine areas of rapid growth (growth plate zones of long bones and rib costochondral junctions). In addition, look at bone marrow quality (bone marrow serous atrophy associated with cachexia) and angulated limb abnormalities (deficiencies/imbalances calcium, phosphorus, vitamin D, manganese, copper, Vitamin A).

Nutritional myopathy

Deficiencies/imbalances of selenium/vitamin E, manganese, copper are the nutritional myopathies most commonly encountered during drought periods. The distribution pattern of the diagnostic degenerative lesions (necrosis, dystrophic mineralisation) include the major muscle groups of the hindquarters, diaphragm, tongue (in suckling animals), oesophagus, myocardium and intercostal muscles.

Copper deficiency

In young growing animals copper deficiency is most commonly associated with skeletal (osteoporosis, osteochondrosis) and central nervous system (demyelination - swayback) abnormalities.

Zinc deficiency

Deficiencies of zinc may be associated with swelling of distal extremities, parakeratosis, deformed hooves and thymic atrophy. Thymic atrophy results in significant immunosuppression, with increased prevalence of infectious diseases, internal parasites and external parasites.

Vitamin A deficiency

Vitamin A is essential for the development and maintenance of the retinal epithelium with deficiencies resulting in retinal dysplasia (blindness). The defective skull bone growth and raised cerebrospinal cord fluid pressure associated with vitamin A deficiency may result in hydrocephalus with cerebellar herniation, narrowing of optic canal with demyelination of the optic nerve. Defective epithelialisation is also responsible for the cutaneous and glossal hyperkeratosis and histologically squamous metaplasia of secretory epithelium (glandular ducts) are strong indicator lesions. Congenital chondrodystrophy of unknown origin (CCUO) in calves, has been documented in periods of drought, low pasture availability and supplemental feeding in Australia. Affected animals are disproportionate dwarfs, with axial rotation of the limbs, and growth arrest lines.

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Most micronutrient imbalances are reversible, but pathological changes take time to resolve as nutritional conditions normalise.

There are exceptions, for example swayback is irreversible and progressive lesions of nutritional myopathy with dystrophic mineralisation and replacement fibrosis result in permanent deficits.

PM investigation of adults, especially pregnant/lactating animals and growing sub-adults. Examine for evidence of:

- Cachexia
- Rumen papilla under-development
- Reproductive abnormalities
- Nutritional myopathy
- Copper deficiency
- Vitamin A deficiency
- Metabolic bone disease
- Nitrate toxicity
- Polio-encephalomalacia
- Pica
- Plant toxicities

Rumen development
With poor quality or lack of adequate fibre/forage during the first 8 months of life of a ruminant, there is a lack of adequate fibre-scratch effect to stimulate normal rumen development. Under-developed rumens have reduced numbers, small and stubby rumen papillae.

Cachexia
Pathologies closely associated with cachexia include low body weight, serous atrophy of fat, pulmonary oedema, muscle atrophy, lymphoid atrophy and thymic atrophy (sub-adults). These cachectic animals are also immunocompromised because of the lymphoid and thymic atrophy.

Reproductive abnormalities and infertility.
Various micronutrient imbalances/deficiencies are associated with abnormal ovarian function, decreased conception rates, embryonic death, abortion/stillbirth and retained placenta.

Nutritional myopathy (see above)

Copper deficiency
In adult ruminant's copper deficiency is associated with ill-thrift, poor hair-coat quality, anaemia, infertility, myocardial necrosis (falling disease) and lameness.

Vitamin A deficiency (see above)
Blindness is the syndrome most commonly described in adults with ataxia and convulsions less commonly reported. Retinal dysplasia and squamous metaplasia of secretory epithelium are the primary pathologies in adults.

Metabolic bone disease
In adult animals where the growth plates have closed the primary syndromes of metabolic bone disease are osteomalacia (abnormal remodelling of bone due to defective mineralisation) and osteoporosis (reduction in bone quantity due to excessive bone resorption).

Nitrate toxicity
There are increased levels of nitrates in drought-stricken grazing.

Polio-encephalomalacia (PEM)
Groundwater frequently contains calcium sulphate and during drought periods with increased evaporation, the mineral concentration rises resulting in sulphur associated PEM.

Pica
During periods of drought various minerals are depleted from soils and as a result vegetation also has low mineral content. Under these circumstances' ruminants seek out mineral rich sources (soil, dead animal matter, licks) increasing the risk of botulism and mineral/heavy metal toxicities.

Plant toxicities
With limited grazing there is increased risk of animals actively ingesting toxic plants, even those deemed unpalatable. Toxic plant species available is dependent on geographic location.

Supplementary feeding risks

- Rumen acidosis
- Mycotoxicosis + Listeriosis
- Plant/Feed toxicity
- Polio-encephalomalacia (PEM)

Significant supplementary feeding (concentrates, hay, silage, fruit and vegetables, etc.) occurs during periods of drought.

Rumen acidosis/metabolic diseases
Seen with highly digestible carbohydrate supplements.

Mycotoxicosis, listeriosis
Observed with the feeding of stored feed sources (hay, haylage, silage).

Plant/feed toxicity
Some toxic plants remain toxic in dried form and so hay contaminated with these plants is a source of toxicity. Fruit and vegetable feeding increase the risk of certain toxicities such as *Brassica* poisoning, sugar-beet-pulp poisoning and citrus-pulp poisoning and these poisonings are frequently associated with sulphur induced polio-encephalomalacia.

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MULTIPLE-CHOICE QUESTIONS

QUESTION 1

Which of the following ruminants would be LEAST susceptible to developing disease syndromes associated with inadequate feed intake?

a. Developing foetus
b. Growing calf/lamb/kid
c. Adult steer
d. Lactating cow
e. Pregnant cow

QUESTION 2

In-utero growth retardation DOES NOT have a permanent negative impact on which of the following parameters?

a. Hide quality
b. Post-natal growth
c. Feed conversion rate
d. Body composition
e. Meat quality

QUESTION 3

Which of the following nutrient deficiencies HAS BEEN associated with thymic atrophy?

a. Vitamin A
b. Vitamin D
c. Calcium
d. Phosphorus
e. Zinc

QUESTION 4

Which of the following is NOT CONSIDERED a pathology of metabolic bone disease?

a. Rickets
b. Osteogenesis imperfecta
c. Osteoporosis
d. Fibrous osteodystrophy
e. Osteomalacia

QUESTION 5

Which of the following micronutrient deficiencies have NOT BEEN associated with nutritional myopathy?

a. Vitamin E
b. Selenium
c. Vitamin D
d. Copper
e. Manganese

QUESTION 6

Which of the following pathologies ARE ASSOCIATED with Vitamin A deficiency?

a. Thyroid gland goitre
b. Retinal dysplasia
c. Thymic atrophy
d. Cutaneous parakeratosis
e. Polio-encephalomalacia

QUESTION 7

Which of the following disease syndromes is NOT reversible?

a. Thyroid goitre
b. Osteoporosis
c. Swayback
d. Parakeratosis
e. Squamous metaplasia of secretory epithelium

QUESTION 8

Falling disease (myocardial necrosis) of adult cows IS A CONSEQUENCE of which of the following micronutrient deficiencies?

a. Copper deficiency
b. Zinc deficiency
c. Manganese deficiency
d. Vitamin A deficiency
e. Vitamin D deficiency

QUESTION 9

Thymic atrophy and generalised lymphoid atrophy ARE features of which of the following?

a. Nutritional myopathy
b. Swayback
c. Falling disease
d. Cachexia syndrome
e. Mycotoxicosis

QUESTION 10

Cases of Listeriosis are MOST COMMONLY observed with the feeding of which of the following?

a. *Brassica* sp
b. Citrus pulp
c. Hay
d. Concentrate
e. Silage

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