Vet Call

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Polioencephalomalacia

Polioencephalomalacia (PEM), or polio, is a term used to describe a particular type of brain damage that can be caused by a variety of agents. The most common causes of polio in beef cattle include high dietary sulfur levels, thiamine deficiency, lead poisoning and salt poisoning/water deprivation. Polio is characterized by a sudden onset of aimless wandering, blindness, head-pressing, stumbling, muscle tremors and possibly by convulsions.

Sulfur toxicity

Polio due to sulfur toxicity is most commonly seen in young cattle (6-18 months old). The disease is usually seen at least one to three weeks after first starting on a diet high in sulfur. Even though a moderate intake of dietary sulfur may cause this disease, only 10%-35% of cattle subjected to high-sulfate diets actually develop signs of the disease. Current knowledge of all nutritional factors that interact to cause sulfur-induced polio is not complete, but thiamine or cobalt deficiency, carbohydrate source and rumen pH, among others, may be involved.

Rumen bacteria normally produce sulfide, but high-concentrate diets (high in readily fermentable starch) that are high in sulfur/sulfate and low in long fiber, or forage-based diets with high levels of sulfur/sulfate, increase the production of sulfide to the level that has been shown to induce polio. Hydrogen sulfide (which smells like rotten eggs) is highly toxic to brain tissue and, when present in rumen gas that is eructated (belched) and inhaled, will cause polio. The concentrations of hydrogen sulfide in the rumen gas cap increase as pH declines, causing acidosis.

To diagnose sulfur-induced polio, it is important that total sulfur (water and feed) intake be considered. The recommended level of dietary sulfur is less than 0.3%, and the maximum tolerated total intake level of 0.4% (as dry-matter intake) is known to cause polio in cattle.

Cattle rations often contain 0.15%-0.2% sulfur as dry matter. Feeds that can be high in sulfur include: water, molasses, beet pulp, gypsum (calcium sulfate, used as an intake limiter in self-fed diets), ammonium sulfate (acidifies urine and is used to prevent urinary calculi), and some grain-processing-byproduct feeds such as corn gluten feed. Some plants, such as kochia, or fireweed, are also linked to polio, probably due to sulfur levels.

A moderate sulfur content in water of 1,000 ppm as sulfate may easily contribute 0.1%-0.2% of dietary sulfur, pushing sulfur intake to the limit of safety. Because of the increasing recognition that the moderate intake of sulfur can cause polio, sulfur toxicosis should be an important consideration when cattle act like they have brain damage, and both feed and water should be tested for total sulfur content.

Treatment and prevention of sulfur-induced PEM involves changing to a lower-sulfate water source, or removing or diluting high-sulfur feeds. In addition, a nonspecific positive response may result from thiamine administration in brain diseases.

Thiamine deficiency

Thiamine is a B vitamin that is normally produced by rumen bacteria and is present in feeds such as green forage, good quality hay, grains and brewer's yeast. Lack of functional thiamine in body tissues can lead to polio.

Diets are rarely, if ever, deficient in thiamine, but rumen microbes can produce enzymes that break down thiamine, reducing the amount available to the animal. Some plants, such as bracken fern and horsetail (equisetum), also produce enzymes that break down thiamine. In addition, microbes can produce structures that resemble thiamine and can take its place in biological processes, but they do not provide the beneficial actions of thiamine.

Some pharmacological products also act in this manner to inhibit coccidia organisms at doses that are lower than are harmful to animals. But, if inadvertently included in the diet at high levels, they can cause thiamine deficiency symptoms (polio).

Lead poisoning

Lead poisoning from paint, petroleum products, and batteries that may be inadvertently left in contact with cattle is a fairly common cause of polio. The treatment in cases of lead poisoning is to remove the source and to administer large doses of thiamine.

Salt toxicosis/water deprivation

Polio can result if cattle are restricted from water for a long enough period of time that they become very dehydrated and are then allowed to consume water rapidly. The same problem can occur if the diet or water source is high in salt and sufficient potable water is not present.

Polioencephalomalacia is an occasional problem for cattle, and if you are confronted with a polio situation, the outcome can be sudden and can include high death loss. A veterinarian should examine any animal that acts strangely, and if you know of the presence of any potential causes of polio, you should bring those to your veterinarian's attention.

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