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Popular Article**Lead Toxicity: An emerging threat to livestock****M. Lakshmi Namratha**

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Abstract

Lead (Pb) is a metal of toxicological importance since ancient times and is recognized as a major environmental health risk throughout the world. Lead intoxication is the most frequently diagnosed poisoning in livestock. Cattle are the most susceptible livestock, with calves the most likely victims. However, lead poisoning can occur in all domestic animals including horses, birds and dogs. Clinical signs in cattle include gastrointestinal and neurological signs with anorexia, bellowing, blindness and head pressing. Management involves identifying the source of toxicity and providing supportive care with chelation therapy.

Introduction

Lead toxicity remains a global significant burden and is a common cause of poisoning of domestic animals throughout the world. Human activities have spread lead widely throughout the environment. Lead poisoning affects cattle of all ages, but is most common in calves (Blakley and Brockman, 1976). It has been estimated that 150,000 cattle worldwide are exposed annually to toxic levels of lead and at least 20,000 acute deaths occur (Bratton and Zmudzki, 1984). Young calves are more susceptible to lead poisoning because of their innate curiosity, their active calcium absorption mechanism and the fact that milk and milk-replacer diets promote lead absorption (Zmudzki *et al.*, 1986). Once the soil is contaminated with lead, it adheres to the soil particles and persists in the upper layer of soil. Lead in gasoline, pesticides and paints contribute to the lead in the soil. Lead enters into the water bodies when soil particles are moved by rain water. Cattle are the most susceptible livestock, with calves the most likely victims. However, lead poisoning can occur in all domestic animals including horses, birds/ poultry and dogs. Pigs are the least susceptible. Lead poisoning is most common among calves because they are curious feeders, and both milk and milk substitutes increase the amount of lead absorbed by calves. Sucking animals can also receive lead in their milk.

Sources of poisoning

Accidental ingestion of lead objects such as batteries, solders thrown near animal farms are important source of poisoning in animals. Ingestion or licking of lead based paints and related products also is a major cause of toxicity in animals. Ingestion of grass near busy highways may contain toxic amounts of lead from auto exhausts. Vapors, fumes and powders generated from lead based industries such as lead smelting, refining and battery manufacturing constitute to major environmental source of poisoning.

Lethal levels of lead in animals

1. Cattle: Intakes greater than 6 mg/kg body weight can lead to chronic poisoning and intakes greater than 10 mg/kg BW may cause acute lead poisoning.
2. Sheep-Generally occurs only in lambs and symptoms of poisoning appear at intakes greater than 4.5 mg/kg BW.
3. Pigs, Goats and Rabbits-More resistant than sheep or cows. Very minor signs of poisoning occur at intakes of 60 mg/kg BW. This is equal to blood concentrations of 130 micrograms per dl.
4. Horses-Respiratory "roaring" occurs at intakes of 6.4 mg/kg BW. Signs of anemia occur at intakes of 7.4 mg/kg.
5. Birds-Poultry can withstand dietary intakes of 100 mg/kg feed with no symptoms. Levels of 500 mg/kg induced serious poisoning.
6. Dogs and Cats-Nervous symptoms of poisoning appear at intakes of 5 mg/kg BW/day.

Pathogenesis:

Lead has an effect on multiple organ systems, especially nervous system, gastrointestinal tract and hematopoietic system. It prevents the biosynthesis of heme by inhibiting certain key enzymes involved in hemoglobin synthesis (Potula and Hu, 1996). Absorbed lead enters the blood and soft tissues and eventually redistributes to the bone. In ruminants, particulate lead lodged in the reticulum slowly dissolves and releases significant quantities of lead. Lead has a profound effect on sulfhydryl containing enzymes, the thiol content of erythrocytes, antioxidant defenses, and tissues rich in mitochondria, which is reflected in the clinical syndrome. In addition to the cerebellar hemorrhage and edema associated with capillary damage, lead is also irritating, immunosuppressive, gametotoxic, teratogenic, nephrotoxic and toxic to the hematopoietic system (The Merck's manual).

Clinical findings

Clinical signs are usually seen before death or animals are found unconscious or dead on the ground. In acute lead poisoning animals show signs of colic, maniacal excitement, circling, muscle twitching, snapping of eyelids, grinding of teeth, depression, ataxia, convulsions followed by death. Abortion in mid to late gestation, opisthotonus, nasal discharges, paralysis may also be noticed. Chronic toxicity occurs after few weeks or months during which cattle are asymptomatic, may suddenly culminate in seizure or death. Horses show dyspnea. A combination of gastro-intestinal and nervous signs may also occur. The gastro-intestinal effects may produce either constipation or diarrhoea. It is often difficult to distinguish lead poisoning from other diseases that affect the nervous system of cattle. A correct diagnosis is extremely important for identifying the problem and preventing a recurrence of the disease.

Prevention

Lead toxicity can be easily prevented by following good management practices in livestock farms.

1. Keep trash away from pastures and other sites used by animals.
2. Used batteries and crankcase oil should be stored and disposed of safely, without spillage and confined to areas where animals have no access.
3. Farm machinery should not be maintained in the barn or in the areas where livestock are kept.
4. Animals should be provided with a balanced diet and ad libitum water in order to prevent pica and unnecessary grazing.
5. Only lead-free paints should be used on surfaces and fixtures to which livestock has access. 6. Because most poisonings occur following a change of location or management procedure, all pastures and holding areas should be inspected carefully before introducing animals to them.

Treatment

1. Treatment only stops or reduces the clinical signs of lead poisoning and must be begun early if an animal is to be saved. 1. Calcium - disodium EDTA: - For large animals, slow I/V injection of 6.6% solution @ 70 mg/ kg/day divided in 2 - 3 doses for 3-5 days. The injection should be repeated after a gap of two days.
2. Supportive therapy includes use of thiamine @ 2-4 mg/kg/BW twice a day for five days, optimization of calcium, copper and zinc stores in the body which reduces the lead absorption from the gastrointestinal tract.

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