Rodenticide Toxicity

A PowerPage Presented By

Due to the large number of toxins in animals, they have been divided over several PowerPages. This PowerPage deals with rodenticide toxicities including the anticoagulant rodenticides bromethalin and cholecalciferol. Ingestion of these is a common reason for dogs to present to an emergency clinic, and prompt intervention can frequently be life-saving.

Anticoagulant Rodenticide

Toxic principle

- The most common type of rodenticide used in North America
  - Warfarin (1st gen), brodifacoum and bromdialone (2nd gen), diphacinone (indandione)
- Toxic effect is by **inhibiting Vitamin K1 epoxide reductase**
  - Prevents activation of vitamin K-dependent coagulation factors **(II, VII, IX, and X)**

Clinical signs

- Depend on location and severity of hemorrhage
  - Commonly into body cavities (abdomen, retroperitoneum, pleural space, etc) and lungs
  - Signs consistent with hemorrhagic shock (pale mm, prolonged CRT, tachycardia, weak pulses)
  - Abdominal distention, respiratory distress (pleural or pulmonary hemorrhage)
  - Frequently occurs 3-7 days after ingestion although compounds can persist for 4-6 weeks

Diagnosis

- Markedly prolonged prothrombin time (PT)
  - Takes 36-72 hours to occur due to depletion of **factor VII** (shortest half life of K-dependent coagulation factors)
- Prolonged activated partial thromboplastin time (aPTT)
  - Takes a longer time to see elevation (typically 3-5 days)
- Rodenticide toxicology screen for definitive diagnosis if unsure which rodenticide ingested

Treatment

- Recent known ingestion
  - Emesis if ingestion within 2-4 hours
  - Activated charcoal +/- sorbitol within 8-12 hours
  - Treat with Vitamin K1 for 4 weeks OR check PT 36-72 hours after ingestion to determine if Vitamin K1 is needed
  - Check PT 48-72 hours after completion of vitamin K1 therapy
- Known or possible previous ingestion +/- recent ingestion
  - Immediately perform a PT
  - Only induce emesis if PT is normal
  - Administer vitamin K1 for 4 weeks
  - Activated charcoal can be given orally
  - Check PT 48-72 hours after completion of vitamin K1 therapy
- Dog presenting with hemorrhage secondary to coagulopathy
  - Plasma transfusion (+ RBC transfusion if indicated)
    - Vitamin K1 may take >24 hours to be effective, plasma needed for immediate hemostasis

    - Use repeated PT or ACT measurements to help determine quantity of plasma to transfuse, typically 10-15 ml/kg
  - If hemorrhage into pleural space resulting in dyspnea, thoracocentesis may be needed
    - Collected blood can be collected by sterile technique and autotransfused
  - If significant hemorrhage into lungs, may need O_2 support or mechanical ventilation
  - Isotonic crystalloids and/or colloids for additional volume support
  - Administer vitamin K1 subcutaneously or orally and continue for 4 weeks
  - Check PT 48-72 hours after completion of vitamin K1 therapy

Bromethalin Rodenticide

Toxic principle

- Inhibits oxidative phosphorylation and ATP production, especially in neurons
- Loss of ability to maintain osmotic gradients, cerebral edema, increased intracranial pressure

Clinical signs

- High doses
  - Soon after ingestion (<12 hrs), see tremors, seizures, hyperexcitability, and hyperthermia
- Lower doses
  - May begin days or weeks after ingestion
  - See ascending paralysis beginning in hindlimbs

Treatment

- If acute, gastrointestinal decontamination (emesis or gastric lavage and activated charcoal)
- Once clinical signs present, largely symptomatic/supportive care
  - Seizure treatment/prophylaxis
  - Treatment for increased intracranial pressure
    - Mannitol and/or furosemide to reduce cerebral edema
    - Incline plane 30° to promote venous return
- Severe clinical signs warrants poor prognosis

Cholecalciferol Rodenticide

Toxic principle

- Precursor converted into active vitamin D after ingestion
- Results in increased intestinal absorption of calcium and mobilization from bones
- Leads to **severe hypercalcemia, hyperphosphatemia** and organ injury

Clinical signs – usually within 36 hours

- PU/PD, GI upset
- **Acute renal failure**
- Cardiac arrhythmias

Diagnosis

- Known exposure to cholecalciferol rodenticide
- Presence of hyperphosphatemia (12h post-ingestion), hypercalcemia (24h post) and azotemia (36-48h post)

Treatment

- If acute, emesis and activated charcoal
- Hypercalcemia present
    - Saline diuresis and loop diuretic (i.e. furosemide) to promote urinary calcium excretion
    - Corticosteroids can be used to decrease intestinal Ca absorption and urinary retention
    - Bisphosphonates (pamidronate) inhibit osteoclast activity and bone re-absorption
        - Most effective means of long-term calcium control
    - Calcitonin can also be used but is largely replaced by bisphosphonates
- Azotemia present
    - Supportive care for acute renal failure
    - Prognosis guarded to grave once progression to renal failure occurs