Anticoagulant rodenticides are more effective than warfarin-based products, but the improved efficacy also poses a greater risk to pets.

Anticoagulant rodenticides—Now More Toxic to Pests and Pets

Margaret Moorman, CVT

Anticoagulant rodenticides are commonly used to kill rats and mice in homes, garages, barns, and storage buildings. Warfarin, discovered in the 1940s, was the first anticoagulant. Multiple ingestions of warfarin are generally required to cause intoxication in the rat or mouse, and the effects typically last for 2 weeks in dogs and cats. Newer anticoagulants (e.g., pindone, chlorophacinone, brodifacoum, Bromadiolone, diphacinone) are more toxic and longer lasting. Only a single feeding of these can cause signs, and the effects in dogs and cats last 3 to 4 weeks or longer.1

**Mechanism of Action**

Anticoagulant rodenticides cause the affected animal’s blood to lose the ability to clot. Anticoagulants inhibit the enzyme vitamin K epoxide reductase so that vitamin K cannot be recycled or regenerated by the body.2 There are four clotting proteins in the body that require vitamin K: K, II, VII, IX, and X. Factor VII has a half-life of 6.2 hours, so it and the extrinsic pathway will be affected first if enough rodenticide has been ingested. Prothrombin time (PT) tests the extrinsic pathway (normal PT time is generally 6 to 12 seconds), so it is the best test for early detection of anticoagulant poisoning. The presence of circulating clotting factors that were produced prior to poison exposure is the cause of the delayed onset of signs (usually 3 to 5 days after ingestion).3

**Asymptomatic Patients**

Calculating a Dose

In order to determine whether a dog or cat ingested a toxic amount, it is useful to calculate the dose of the anticoagulant involved:

- **Step 1**—Assume the worst-case scenario. What is the most that the animal could have consumed?
- **Step 2**—Multiply the percent of active ingredient by 10 to get the mg of active ingredient per gram of rodenticide.
- **Step 3**—Multiply mg/g by the amount of rodenticide ingested in grams.
- **Step 4**—Divide by kg of bodyweight to determine the dose ingested.

For example, a 20-lb dog ingests part of a box of brodifacoum rat bait weighing 0.88 oz. The concentration of the bait is 0.005%. The owner cannot say how much of the bait was left because she threw the box away, but she does not think the dog could have ingested more than 2 teaspoons.

- **Step 1**—The worst-case scenario is 0.88 oz (1 oz = 28.4 g; therefore, 0.88 oz = 25 g of bait).
- **Step 2**—0.005% x 10 = 0.05 mg active ingredient per gram of bait
- **Step 3**—0.05 mg/g x 25 g of bait = 1.25 mg active ingredient in 0.88 oz of bait

**Symptomatic Patients**

Clinical Signs of Toxicosis

Healthy adult animals usually do not become symptomatic until 3 to 5 days after exposure due to a stored supply of clotting factors, although signs have been noted within 1 day. The signs relate to the body’s inability to clot and depend on where the bleeding occurs. Acute death is usually the result of bleeding into the cranial or thorax. More common signs are lethargy, anorexia, or pale mucous membranes. Other signs include dyspnea due to lack of oxygen secondary to anemia or bleeding into the lungs, hematemesis or hematochezia due to bleeding into the intestinal tract, and lameness or stiff, swollen joints because of bleeding into joint capsules or around joints. In addition, ecchymosis or petechiation may be seen when subcutaneous bleeding occurs.

**Treatment**

In a symptomatic animal, fresh frozen plasma or whole blood may be necessary to support the animal until the new clotting factors are produced. New clotting factors will start to form forms hours after administration of vitamin K1. Keep the patient warm and quiet until stabilized, and use oxygen if necessary in animals that are severely dysemic. A chest tap may be necessary if blood accumulation occurs in the pleural cavity. Anticoagulants are highly protein bound. Therefore, highly protein-bound drugs, such as furosemide, corticosteroids, and some sulfonamides, should be avoided to prevent worsening of the clinical signs.

**Home Care**

There are several instructions for the owner after the dog is released from the hospital:

- It is recommended that vitamin K1 be given with a fatty meal, such as canned dog or cat food.
- Restrict exercise until the final PT has confirmed that the animal is no longer affected by the anticoagulant. This is especially pertinent for very active dogs. Leash walks with no heavy play are recommended to prevent any injury that may cause bleeding.
- Vitamin K must be given until the prescription is finished, even if the animal’s appearance and behavior is normal.

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[Image of a diagram showing the mechanism of action of anticoagulant rodenticides]
REFERENCES

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