

PEER-REVIEWED

# Paintball toxicosis in dogs

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In a contest similar to capture the flag, opponents in a paintball game shoot paintballs at each other from air guns. From January 1998 to January 2003, the ASPCA Animal Poison Control Center (APCC) received 44 calls regarding paintball ingestion by dogs that subsequently developed clinical signs. In some cases, the dogs may have ingested as many as 500 paintballs at one time. Paintballs come in various colors, and one box may contain more than 1,000 paintballs. Paintball ingredients vary depending on the manufacturer and may include polyethylene glycol, glycerol (glycerin), gelatin, sorbitol, dipropylene glycol, mineral oil, dye, ground pig skin, and water.

## Clinical signs

In dogs, the most common clinical signs reported to the ASPCA APCC were vomiting (with or without paint; 77%), ataxia (45%), diarrhea (27%), and tremors (25%). These signs occurred as early as one hour after ingestion. Other signs included tachycardia, weakness, hyperactivity, hyperthermia, blindness, and seizures. Laboratory abnormalities included electrolyte concentration disturbances and acidosis. Of the 44 cases, hypernatremia was the most common laboratory abnormality (22%). Hyperchloremia and hypokalemia were also reported. In two cases, the dogs were euthanized because their central nervous system signs were unresponsive to treatment; no other deaths were reported. Depending on the rapidity of onset, duration, and severity of hypernatremia, polydipsia, depression,

and coma are possible sequelae. The exact number of ingested paintballs required to cause clinical signs is unknown. In one case, a 90-lb (41-kg) Labrador retriever showed clinical signs after ingesting 15 paintballs (ASPCA APCC Database: Unpublished data, 2003).



## Proposed mechanisms of action

### Hypernatremia

The mechanism of action of hypernatremia in these cases has not been determined. A possible explanation for the clinical presentation and biochemical abnormalities is an alteration of the body's water balance. Polyethylene glycol, glycerol, and sorbitol are reported to be osmotically active agents and have been used as osmotic laxatives. Osmotic laxatives exert hygroscopic and local irritant actions, moving water from the body tissues into the bowel lumen.<sup>1</sup> When administered in large-enough quantities, osmotically active agents can markedly increase plasma osmolality.<sup>2</sup> Hypernatremia has been reported with the use of similar osmotic laxatives, such as lactulose.<sup>3</sup> Sorbitol has been reported to cause hypernatremia in people when administered as an osmotic cathartic with repeated doses of activated charcoal.<sup>4</sup> In one report of individuals receiving multiple doses of activated charcoal, 6.6% developed hypernatremia.<sup>5</sup>

The type and severity of clinical signs associated with hypernatremia are thought to be related more to the rapidity of onset of the sodium elevation rather than the absolute magnitude of change in the sodium concentration.<sup>6</sup> In dogs, the reference range for the serum sodium concentration is 135 to 155 mEq/L.<sup>7</sup> In acute hypernatremia, signs may be noted when the serum sodium concentration exceeds 160 mEq/L.<sup>7</sup> Signs consistent with acute hypernatremia are usually

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neurologic and result from the osmotic movement of water out of brain cells.<sup>6</sup> This may cause a rapid decrease in brain volume, and cerebral vessels may swell and rupture, causing focal hemorrhage.<sup>6</sup> Brain cell shrinkage may cause tearing of fine meningeal vessels, resulting in subarachnoid and subcortical hemorrhage and venous sinus thrombosis.<sup>8</sup>

With chronic hypernatremia in dogs, in which grad-

patients with hypernatremia have benefited from warm-water enemas. Activated charcoal administration would probably be of little benefit and could be contraindicated if the activated charcoal contains sorbitol.

In symptomatic and asymptomatic animals, obtain blood for measuring serum electrolyte concentrations and acid-base status. In symptomatic animals, monitor these values every two to four hours until clinical signs

resolve and electrolyte and acid-base derangements normalize. At a minimum, regardless of the effectiveness of decontamination, observe patients for at least four hours for clinical signs, and assess their electrolyte concentrations and acid-base statuses. This is especially true in cases of large ingestions



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ual increases of serum sodium concentrations last more than 24 to 48 hours, the brain can compensate over time to the hypertonic state by producing intracellular solutes (idiogenic osmoles) that maintain intracellular fluid balance and prevent development of severe clinical signs.<sup>6</sup> With the gradual onset of hypernatremia, neurologic signs may not be noted until the serum sodium concentration exceeds 175 mEq/L.<sup>8</sup>

### Acidosis

The mechanism of action for the acidosis documented after paintball ingestion is unknown. Metabolic acidosis has been reported in a person who ingested a large amount of polyethylene glycol.<sup>4</sup>

### Treatment

In dogs suspected or known to have ingested paintballs, minimize exposure and provide symptomatic and supportive treatment. In those displaying severe clinical signs such as seizures, treat the neurologic signs and stabilize the patient first. In asymptomatic animals, induce emesis within one hour of exposure. After emesis, administering warm-water enemas may help stimulate movement of the paintballs through the gastrointestinal tract. According to ASPCA APCC data,

or if the amount ingested is unknown.

In hypernatremic patients, administer intravenous fluids (*e.g.* 5% dextrose in water or 2.5% dextrose in 0.45% saline solution) at a rate of one-and-a-half to two times maintenance until serum sodium concentrations are normal. In dogs with chronic hypernatremia, reduce the serum sodium concentration slowly by using a slower fluid rate over a longer time frame to allow the idiogenic osmoles to dissipate; otherwise, cerebral edema may develop.<sup>8</sup>

Consider intravenous potassium chloride supplementation if the potassium concentration falls below 2.5 mEq/L, but do not exceed 0.5 mEq/kg/hr.<sup>9</sup> Control tremors and seizures with diazepam (0.5 mg/kg as an initial dose).<sup>9</sup> Metoclopramide hydrochloride (0.2 to 0.4 mg/kg subcutaneously or intramuscularly q.i.d.) may be used to control vomiting.<sup>9</sup> Provide supportive care, such as correcting acidosis and thermoregulation abnormalities, as needed. Clinical signs usually resolve within 24 hours with symptomatic and supportive care.

### Conclusion

Because little is known about the mechanisms of action and lethal dose of paintballs, consider any paintball ingestion as potentially serious. Induce emesis in asymp-

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tomatic animals when ingestion has occurred less than an hour before presentation. Administer intravenous fluids to minimize the effects of hypernatremia, and provide specific and supportive care for neurologic signs. Although paintball toxicosis is potentially fatal, most affected animals recover within 24 hours.

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