

TO PUKE OR NOT TO PUKE

TOXICOLOGY

TOXICOLOGY TIPS IN THE POISONED PATIENT

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In veterinary medicine, with any poisoned patient, the primary treatment for toxicant exposure should be decontamination and detoxification, along with symptomatic and supportive care. Initial steps for veterinary team members to take when presented with a poisoned patient include performing immediate triage and stabilization, obtaining an appropriate history, performing a thorough physical examination, and initiating treatment (including decontamination and stabilization).

Appropriate decontamination and therapy is indicated to improve the overall prognosis and outcome of the small animal poisoned patient. The use of decontamination, if and when appropriate, should be implemented to help prevent further toxicant absorption. Gastrointestinal decontamination (including emesis induction and/or administration of activated charcoal with a cathartic) is considered the best method of limiting absorption and preventing continued exposure to potential toxicosis in veterinary medicine. This is particularly beneficial with potentially harmful or life-threatening ingestions. It is imperative, however, to consider whether decontamination is appropriate, as it may be too late or contraindicated (resulting in potentially further harm). The potential risks associated with induction of emesis need to be considered.

Obtain an Appropriate Toxicology History

Some key questions to ask prior to consideration for emesis induction include:

- What was the product ingested? Do you know the active ingredient?
- Can you bring me the original box, container, or pill vial?
- How many total tablets could have been ingested? What are the minimum and maximum amounts that your pet could have been exposed to?
- Was this an extended- or sustained-release product? Was there an extra “letter” behind the brand name (e.g., Claritin vs. Claritin-D)?
- When did your pet get into this?
- Has your pet shown any clinical signs yet?
- Did you give your pet anything at home (e.g., hydrogen peroxide, salt, milk) when you found out he was poisoned?

Triage the Poisoned Patient Appropriately

The second important consideration is to make sure that pet owners are instructed to do the following:

- Safely remove the pet from the area of poisoning so additional ingestion does not occur.
- Do *not* give any home remedies found circulating on the Internet (e.g., milk, peanut butter, oil, grease, or salt).
- Do not induce emesis without consulting a veterinarian or an animal poison control first.
- Bring the pill vial, bait station, or container in to the veterinarian so that he or she can assess the bottle for verification of the product name and/or active ingredient.
- Have the pet owner call the original pharmacy to find out how many total pills were prescribed, and attempt to back-count how many were ingested.
- Seek immediate veterinary attention.
- Provide adequate ventilation (e.g., rolling down the windows, turning on the air conditioner) if emesis occurs with zinc phosphide toxicosis, as the phosphine gas is also poisonous to humans.

Once the poisoned patient is presented to the clinic, veterinarians should do the following:

- Reverify the spelling of the product and confirm the active ingredient (AI).
- Determine if the product is a sustained-release (SR), extended-release (XR), or long-acting (LA) product. These initials will follow the name of the drug on the vial.
- Evaluate whether the patient should have emesis induced (see below).
- Stabilize the patient based on triage and physical examination findings (e.g., temperature, heart rate, pulse rate, pulse quality).
- Call for medical assistance and toxicology advice, if needed.

Be Aware of the Indications or Contraindications for Emesis Induction

The goal of decontamination is to inhibit or minimize further toxicant absorption and to promote excretion or elimination of the toxicant from the body. Decontamination can only be performed within a narrow window of time for most substances; it is important to obtain a thorough history and time since exposure in order to identify whether decontamination is safe for the patient or if it will actually be beneficial for the patient. Decontamination categories may include ocular, dermal, inhalation, injection, gastrointestinal (GI), forced diuresis, or surgical removal to prevent absorption or enhance elimination of the toxicant.

One of the primary ways of decontaminating veterinary patients is via emesis induction. While gastric lavage is often more effective at removing gastric contents, it is less often performed in veterinary medicine as it requires intravenous (IV) catheter placement, sedation, intubation with an appropriately inflated endotracheal tube (ETT), and appropriate gavage technique. Veterinarians should be aware of which circumstances are appropriate for emesis induction versus gastric lavage and should be aware of contraindications for emesis induction.

Appropriate Timing of Decontamination

Emesis induction should only be performed with recent ingestion of a toxicant or unknown time of ingestion in an *asymptomatic* patient (see Table 1). The more rapidly emesis is induced postingestion, the greater yield of recovery of gastric contents. Studies have shown that gastric recovery within 1 hour after toxin ingestion was approximately 17% to 62%. When emesis was induced within an even shorter time span (within 30 minutes), mean recovery of gastric contents was approximately 49% (range 9% to 75%). If several hours have elapsed since ingestion, the contents have likely moved out of the stomach and emesis will no longer be of benefit. While delayed emesis may still sometimes be successful, the amount of gastric recovery significantly decreases as time passes. That said, induction of emesis can be performed in *asymptomatic* patients up to 4 hours postingestion, particularly with certain toxicants (Lee 2010; Peterson 2006).

In certain circumstances, delayed emesis induction can be performed within 4 to 6 hours of ingestion, provided the patient remains *asymptomatic* under the following circumstances: when certain toxins that delay gastric emptying are ingested (e.g., salicylates, opioids, anticholinergics, tricyclic antidepressants) or if the toxin is known to physically stay in the stomach for a longer duration of time or to form a large bezoar or concretion (e.g., iron tablets, a large amount of chewable multivitamins, bone or blood meal). Additional examples include:

- Large wads of xylitol gum
- Large amounts of chocolate
- Grapes and raisins
- Foreign material (e.g., sawdust/wax, kitty litter, bone meal)

Contraindications for Emesis Induction

Patients that are already symptomatic for the toxicosis should never have emesis induced. Certain toxicoses may result in severe sedation or a decreased gag reflex or may reduce the seizure threshold, increasing the risk for aspiration pneumonia during emesis induction. Patients with a lowered seizure threshold have the potential to develop seizures during emesis induction. As the patient is already symptomatic, the toxin has likely been already absorbed, and emesis induction is typically unrewarding.

Certain animals with underlying medical concerns should not have emesis induced (particularly at home by the pet owner) due to a higher risk of aspiration pneumonia or secondary complications. Examples include a prior history of laryngeal paralysis, megaesophagus, aspiration pneumonia, and upper airway disease. Likewise, certain species and breeds may limit our ability to perform emesis induction. Most dogs, cats, ferrets, and potbelly pigs can be safely induced to vomit (Bihun and Bauck 2004). Certain breeds (e.g., pug, English bulldog, shih tzu) with brachycephalic syndrome (e.g., elongated soft palate, stenotic nares, everted sacculles, and a hypoplastic trachea) may be better candidates for sedation and gastric lavage rather than emesis induction due to the risks of aspiration pneumonia (Lee 2010). Rabbits, ruminants (e.g., sheep, cattle, llamas, and goats), horses, birds, and rodents (e.g., chinchillas, rats, gerbils) cannot safely have emesis induced or may not anatomically be able to vomit (Bihun and Bauck 2004).

Likewise, there are certain toxic ingestions where emesis should never be induced. Emesis should not be performed when agents such as caustic or corrosive substances (e.g., undiluted drain cleaners, toilet bowl cleaners, hydrochloric acid, concentrated sodium hypochlorite, lye products) are ingested. These agents can result in further burns and corrosive injury to the stomach, esophagus, and mouth when vomiting occurs after ingestion. In addition,

if hydrocarbons and petroleum distillates (e.g., gasoline, mineral spirits, fuel, kerosene, furniture polish oils) are ingested, emesis should never be induced. These low-viscosity liquids are very easy to aspirate when the patient vomits; therefore, emesis is contraindicated due to the high risk of aspiration.

Table 1. Emesis Induction: Indications and Contraindications

<i>When Emesis Should Be Performed</i>	<i>When Emesis Should Not Be Performed</i>
With recent ingestion (< 1 hour) in an asymptomatic patient	With corrosive toxicant ingestion (e.g., lye, ultra-bleach, batteries, oven-cleaning chemicals)
With unknown time of ingestion in an asymptomatic patient	With hydrocarbon toxicant ingestion (e.g., tiki-torch oil, gasoline, kerosene)
When ingestion of a product known to stay in the stomach for a long time is ingested in an asymptomatic patient (e.g., grapes, raisins, chocolate, xylitol gum)	In symptomatic patients (e.g., tremoring, agitated, seizing, hyperthermic, hypoglycemic, weak, collapsed)
	In patients with underlying disease predisposing them toward aspiration pneumonia or complications associated with emesis induction (e.g., megaesophagus, history of aspiration pneumonia, laryngeal paralysis)

Use the Appropriate Emetic Agents

Emetic agents work by causing local gastric irritation, stimulating the central nervous system (CNS) chemoreceptor trigger zone (CRTZ), or through a combination of gastric irritation and CNS stimulation. Considerations in choosing an emetic agent are broad and varied. Many home or Internet remedies are used without success and have the potential of causing further harm. Emetic agents are not effective if an antiemetic such as ondansetron or maropitant has been previously administered. Currently, the only home recommendation for dog owners is hydrogen peroxide, while veterinary-prescribed emetic agents include apomorphine hydrochloride (dog) and xylazine hydrochloride (cat) (Lee 2010; Peterson 2006).

Hydrogen peroxide (H_2O_2) works by local irritation of the oropharynx and gastric lining, which results in a gag reflex. It is usually recommended for oral administration by the dog owner when transportation to a veterinary clinic is delayed. Only a 3% hydrogen peroxide solution should be used, as higher concentrations can potentially be corrosive to the GI mucosa. Adverse effects associated with use of H_2O_2 as an emetic agent include irritation to the GI tract, gastric dilatation and/or volvulus (dogs), and potential for aspiration pneumonia (ibid.). Hydrogen peroxide is not a reliable emetic in cats and its use generally is *not* recommended in this species. In addition, cats can develop profound clinical signs from the administration of H_2O_2 , including profuse foaming from the mouth and severe hemorrhagic gastritis.

Apomorphine hydrochloride is a centrally acting emetic agent. Administration results in stimulation of the CRTZ, quickly followed by emesis. Adverse effects associated with apomorphine administration are prolonged emesis and ocular irritation when administered subconjunctivally (ibid.). Apomorphine should not be used in cats, as it is not considered to be effective. Apomorphine should not be used when there has been ingestion of medications that result in compounding of symptoms (e.g., respiratory or CNS depression) or with antidopaminergic drugs (e.g., metoclopramide) that prevent emesis from occurring.

Xylazine hydrochloride is a centrally acting emetic agent used primarily in cats. Xylazine does not reliably produce an emetic response in dogs, and thus is not recommended in dogs as an emetic agent. Adverse effects associated with xylazine include bradycardia, sedation, tremors, and respiratory depression. Xylazine should not be used in cats that have ingested medications (e.g., other alpha-adrenergic agonist drugs) or products that may result in compounding of bradycardia, respiratory depression, sedation, or CNS depression symptoms (ibid.).

Methods that are not recommended for emesis induction include digital induction of emesis, syrup of ipecac, liquid soaps, dry mustard powders, and salt. Digital induction of emesis often results in physical injury to the pet owner (dog bite), or injury to the pet's throat and soft palate. Syrup of ipecac has historically been recommended to induce

emesis, but is no longer the standard of care. Its cardiotoxic potential and tendency to result in prolonged vomiting, lethargy, and diarrhea have caused it to fall out of favor in both human and veterinary medicine (*ibid.*). Soaps, mustard powders, and table salt are not reliable as induction agents and may be detrimental (e.g., resulting in further complications, such as hypernatremia of the patient).

Activated Charcoal

After an appropriate history, triage, physical exam, and initial decontamination procedures have been performed in the poisoned pet, the next step is the administration of activated charcoal (AC), if appropriate. Activated charcoal should not be given to the poisoned patient when the toxicant does not reliably bind to AC (see below) or when it is contraindicated to administer AC (e.g., salt toxicity, poor gag reflex). In addition, symptomatic patients at risk for aspiration pneumonia should not be administered AC orally. Finally, the administration of AC with a cathartic should be cautiously used in dehydrated patients due to the potential (albeit rare) risks for hypernatremia secondary to free water loss in the GI tract.

When you are administering AC, it should ideally be given within 5 minutes of ingestion to be most effective. In veterinary medicine, this is almost impossible due to driving time (to the clinic), lapsed time since ingestion, time to triage, and the amount of time it takes to physically deliver AC (e.g., syringe feeding, orogastric tube). As a result, administration of AC is often delayed for up to an hour or more. As time since ingestion is often unknown (e.g., pet owner coming home from work to find the pet poisoned), decontamination (including emesis and administration of AC) is often a relatively benign course of action, provided the patient is not already symptomatic. As always, when administering *any* drug, it is important that benefits outweigh the risks, and that complications be prevented when possible. In veterinary medicine, administration of AC with a cathartic as long as 6 hours out may still be beneficial with certain types of toxicosis, particularly if the product has delayed release (e.g., extended release [XR] or sustained release [SR]) or undergoes enterohepatic recirculation (see multidose AC below). While human medicine has moved away from administration of AC with poisoned patients, the aggressive use of AC in veterinary medicine is still warranted, as this is often our last line of defense when it comes to adequately decontaminating our patients. Certain modalities of therapy—e.g., antidotes (such as fomepizole, pralidoxime chloride [2-PAM], digoxin-specific antibody fragments), plasmapheresis, hemodialysis, mechanical ventilation—along with financial limitations of pet owners—limit our ability to treat poisoned pets aggressively as compared to human medicine. As a result, the continued use of AC in veterinary medicine is still warranted as a first line of defense therapy. Current recommended dosing for single-dose AC is 1–5 g of AC/kg with a cathartic (e.g., sorbitol) to promote transit time through the GI tract.

Binding Properties of Activated Charcoal

Before administering AC and a cathartic, it is imperative to consider whether or not the patient has a contraindication for its administration. Contraindications for AC administration include severe sedation, decreased gag reflex, or intestinal obstruction. Likewise, if the toxicant does not physically bind to AC, it is contraindicated to administer AC. Examples of toxicants that do not absorb reliably to AC include ethylene glycol, alcohol, xylitol, and heavy metals. Contraindications for cathartic administration include hypernatremia, dehydration, and salt toxicosis (e.g., salt, ice melters, homemade play dough), as fluid loss through the intestinal tract can result in excessive free water loss and severe, secondary hypernatremia.

Multidose Activated Charcoal

Human studies have found that multidose AC significantly decreases the serum half-life of certain drugs, including antidepressants, theophylline, digitoxin, and phenobarbital. While veterinary studies are lacking, there is likely an added benefit from using multidose AC, provided the patient is well hydrated and monitored appropriately. Certain situations or toxicities, including drugs that undergo enterohepatic recirculation; drugs that diffuse from the systemic circulation back into the intestinal tract down the concentration gradient; or ingestion of SR, XR, or long-acting (LA) release products, will require multidose administration of AC. Keep in mind that when administering multiple doses of AC to a patient, the additional doses ideally should *not* contain a cathartic (e.g., sorbitol), due to increased risks for dehydration and secondary hypernatremia. Current recommended dosing for multiple doses of AC is 1–2 g of AC *without a cathartic* per kg of body weight, p.o. q 4–6 hours for 24 hours.

Contraindications of Activated Charcoal

Contraindications for AC include endoscopy (which would obscure visualization), abdominal surgery of the GI tract, gastric or intestinal obstruction, gastrointestinal hemorrhage or perforation (due to pathology, caustic injury, etc.), recent surgery, late-stage presentation with clinical signs already present, dehydration, lack of borborygmi,

ileus, hypernatremia, hypovolemic shock, compromised airway (risk for aspiration pneumonia), and ingestion of a caustic substance or hydrocarbon (due to increased risk for aspiration pneumonia). In patients that have an unprotected airway that are at risk for aspiration pneumonia (e.g., a depressed state of consciousness, excessive sedation), the use of AC is contraindicated without ETT intubation (to protect the airway during gastric lavage and AC administration).

Conclusion

The appropriate and careful use of decontamination of the poisoned patient should be considered. Thorough history taking and physical examination of the patient is imperative prior to emesis induction. Recognizing contraindications for emesis induction, or which emetic to use for emesis induction, is also imperative. With careful and thorough evaluation of the poisoned patient, proper decontamination can be performed confidently with safety and efficacy to aid in ensuring a positive outcome.

References

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