Decontamination of the Poisoned Patient: What, Why, When and How
April 11, 2017

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What is Pet Poison Helpline?
• 24/7 animal poison control center
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  – DACVECC
  – DACVIM
  – 7 PharmDs
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Speaker Introduction

Renee Schmid, DVM

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Pet Poison Helpline
Minneapolis, Minnesota

Today’s Goals

• Review the different methods of decontamination
• Discuss the pros and cons of each method of decontamination
• Discuss how to choose the ideal decontamination method
Decontamination methods: Types

• Ocular
• Dermal
• Inhalation
• Gastrointestinal

Decontamination methods: Ocular

• Indications
  – Irritant or corrosive chemical exposure
  – pH (acid vs alkaline)
  – Key words on bottle (caution vs danger)
  – If it causes burns to the skin...it will damage the eye
• Perform as quickly as possible
• Have owners start at home
• Best flush to use:
  – Eye wash
  – Tap water
  – LRS or saline
  – Avoid eye drops (Visine or redness reducers)

Decontamination methods: Ocular

• Irritant
  – Owner may be able to perform
  – Irrigate for 10-15 minutes
  – Monitor for signs of irritation
    – Pawing or rubbing at the eye
    – Redness
    – Lacrimation
    – Squinting
    – Swelling
  – Symptomatic pets should be evaluated by a DVM

• Corrosive
  – Owner should attempt to irrigate at home for 15-20 minutes
  – Veterinarian should irrigate the eye for 15-20 minutes with eye wash
  – Fluorescein stain
  – Topical antibiotic ointment or drops
  – Elizabethan collar (E-collar) to preventing self-trauma
  – Monitor for signs or worsening
Decontamination methods: Dermal

**Indications**
- Corrosives or irritants
- Systemically absorbed toxins
- Glues or adhesives
- Prevent oral exposure by self-grooming
- Remove unwanted substances
- Paresthesia
- Burns

**Use personal protective equipment**
- Gloves
- Glasses or goggles
- Gown or long sleeves

**Irritants**
- Caution signal word
- Mild redness/irritation
- Rinse/bathe
- Topical vitamin E?

**Corrosive**
- Danger signal word
- Alkaline pH >11.5
- Acid pH <2-3
- Rinse for 15 minutes
- Bathe with dish soap
- Burn care

**Systemically or orally absorbed toxins**
- Tea tree oil
- Topical pain creams
- Estrogen creams
- Permethrin/Pyrethrin (cats)
- Psoriasis cream
- 5-FU

- Bathe 2-3 times with a degreasing dish soap
- Activated charcoal may be indicated
- Blood work and supportive care will depend on toxin type

**Use personal protective equipment**
- Gloves
- Glasses or goggles
- Gown or long sleeves

**Corrosive**
- Danger signal word
- Alkaline pH >11.5
- Acid pH <2-3
- Rinse for 15 minutes
- Bathe with dish soap
- Burn care
Decontamination methods: Dermal

- **Glues/Adhesives**
  - Typically non-toxic
  - Adhere to eyelid, teeth, skin/fur
  - Loosen with oil
  - Bathe
  - Clip fur
  - Do nothing?

- **Gasoline/hydrocarbons**
  - Defatting dermis
  - Risk for aspiration
  - Inhalation-CNS depression
  - Bathe multiple times with degreasing dish soap
  - Analgesics

Decontamination methods: Dermal

- **Burns**
  - Treatment depends on the degree and BSA
  - If within 2 hours, rinse with cool water for 30 minutes
  - First degree
    - Lavage and topical therapy
  - Second or third degree
    - Debridement
    - Silver sulfadiazine
    - Analgesics
    - Monitor for metabolic derangements (sepsis)

Decontamination methods: Inhalation

- **Indications**
  - Concentrates or corrosives
  - Smoke inhalation
  - Gas
    - Chlorine
    - Carbon Monoxide
    - Natural
Decontamination methods: Inhalation

- Remove animal from the source
- Minor irritants = fresh air
- Concentrates or corrosives
  - Bleach and ammonia mixture
- Smoke inhalation
  - Carbon monoxide – decreased oxygen carrying
  - Toxic chemicals - variable
  - Thermal injury – edema, erosions, ulcerations
  - Hydrogen cyanide – cyanide toxicity
- Animals with underlying respiratory disease may require more intensive treatment.

Decontamination methods: Inhalation

Birds

- Very sensitive
- Fragrance, Teflon, respiratory irritants
- Treatment
  - Remove from source
  - Humidified oxygen cage
  - Heat support
  - Fluids

Decontamination methods: Gastrointestinal

- Emesis
- Gastric lavage
- Activated charcoal
- Cathartics
- Whole bowel irrigation
- Endoscopy and surgical removal
Decontamination methods: Emesis

**Indications**
- Asymptomatic
- Foods
- Medications
- Large ingestions
- Rodenticides
- Small, dull foreign objects
- No breed or health risk

**Contraindications**
- Species to avoid inducing vomiting
  - Rabbits
  - Ruminants
    - Sheep, cattle, llamas, and goats
  - Horses
  - Birds
  - Rodents
    - Chinchillas, rats, gerbils

- Symptomatic
  - Already vomited to bile/empty
  - History or risks of aspiration pneumonia
    - Laryngeal paralysis
    - Megaesophagus
  - Sharp/dangerous objects
  - Corrosive agent
    - Punctured batteries, disc batteries
    - Alkaline substances pH>11
    - Acidic substances pH <3
  - Hydrocarbons
    - Gasoline
    - Kerosene
    - Motor oil

- Species to avoid inducing vomiting
  - Rabbits
  - Ruminants
    - Sheep, cattle, llamas, and goats
  - Horses
  - Birds
  - Rodents
    - Chinchillas, rats, gerbils
### Decontamination methods: Emesis

**Gastric content recovery**
- 49% (range 9-75%) with emesis < 30 minutes after ingestion
- 17-62% 1 hour after ingestion
- Emesis most commonly done within 2 hours after ingestion

**Safe emesis up to 6 hours after ingestion**
- Grapes, raisins
- Chocolate
- Xylitol gum
- Bezoars
- Massive ingestions
- Drugs that decrease gastric emptying
  - Opioids
  - Salicylates
  - Anticholinergics
  - Tricyclic antidepressants

### Decontamination methods: Emesis in Dogs

**Apomorphine**
- Dopaminergic drug
  - Stimulates dopamine-2 receptors in CRTZ
- 0.03 mg/kg IV/0.04 mg/kg IM
- Crush tablet for conjunctival administration
  - ½ tablet for small dog
  - 1 tablet for large dog

**Hydrogen peroxide**
- 3%, fresh, bubbly, non-expired
- Gastric irritant
- 1-2 ml/kg
  - (1/2 to 1 tsp per 5 lbs)

### Hydrogen peroxide use in dogs

*Effects of oral 3% hydrogen peroxide used as an emetic on the gastroduodenal mucosa of healthy dogs*

*Vanderbilt University DOG*
Hydrogen peroxide use in dogs

- 7 healthy dogs with no endoscopic evidence of gastritis
  - 1 dog was assigned as the control and given apomorphine
- New, previously unopened bottle of hydrogen peroxide
- 2ml/kg administered orally with a maximum of 45ml
- Gastric biopsies taken
  - 0, 4, 24 hours, 1 and 2 weeks post administration
- Visual gastric mucosa lesions at 4 hours in all dogs
  - Worsened by 24 hours
- Mild to moderate duodenal mucosal lesions by 24 hours in all dogs
- Histopathology
  - Most severe gastric lesions seen at 4 hours was hemorrhage
  - At 24 hours degeneration, necrosis, and mucosal edema
  - At 1 week, inflammation
  - At 2 weeks, most visual and histopathologic lesions were resolved

Decontamination methods: Emesis in Cats

Xylazine
- α-2 adrenergic agonist
- Dose: 0.44 mg/kg, IM
- Antidote: Yohimbine
  - 0.25-0.5mg/kg IM

Dexmedetomidine
- α-2 adrenergic agonist
- 5-10 mcg/kg IM
- Antidote: Antisedan
- Cons to both:
  - Efficacy—May be as low as 50%
  - Excessive sedation
  - Cardiovascular collapse

Dexmedetomidine vs xylazine in cats

Abstract

Decontamination methods using dexmedetomidine or xylazine in cats: a randomized trial.

Decontamination of ingestion of xylazine in cats was evaluated in a randomized clinical trial, comparing 2 commonly used decontamination methods: xylazine and dexmedetomidine. Cats were divided into 3 groups: control, xylazine, and dexmedetomidine. Decontamination was performed by intramuscular injection of either xylazine (0.44 mg/kg) or dexmedetomidine (5 mcg/kg). Blood samples were collected prior to and 24 hours after decontamination for measurement of xylazine and dexmedetomidine concentrations. Results: Decontamination with xylazine resulted in significantly lower xylazine concentrations compared to dexmedetomidine (p < 0.05). There was no statistically significant difference in dexmedetomidine concentrations between the 2 groups. Conclusions: Xylazine is a more effective decontamination agent than dexmedetomidine in cats.
Dexmedetomidine vs xylazine in cats

Thawley and Drobitz: JAAHA
• 43 cats in study
• No emesis in hydrogen peroxide group n=30%
  – 1tsp/5-10lbs body weight
• Xylazine: Emesis occurred in 11 out of 25 cats 44%
  – Median time to emesis 10 minutes
• Dexmedetomidine: Emesis occurred in 13 out of 16 cats 81%
  – Median time to emesis 5 minutes
  – Median dose 7mcg/kg

Willey et al.: JAVMA
• 47 cats in study
• Xylazine: Emesis occurred in 9 out of 21 cats 43%
  – 0.36-.64mg/kg IM
• Dexmedetomidine: Emesis occurred in 15 out of 26 cats 58%
  – 6-18mcg/kg IM
• Main side effect for all was sedation

Decontamination methods:
Emesis in Cats

Methods not recommended
• Hydrogen peroxide
  – Not very effective
  – Hemorrhagic gastritis
  – Fatalities have occurred
• Apomorphine
  – Not effective
  – Possible over-stimulation of CNS
  – CRT12 stimulated by a-2 agonists in cats vs. dopaminergic receptors
Decontamination methods: Emesis

Inappropriate methods
• Salt: Hypernatremia
• Syrup of ipecac: Cardiac effects and prolonged vomiting
• Digital stimulation: Physical injury
• Liquid dish soap: Ineffective, aspiration risk
• Raw eggs: Ineffective
• Tabasco: Ineffective
• Mustard: Ineffective
• Any other creative technique!

Decontamination methods: Gastric lavage

Indications
• Species that do not vomit
• Unsuccessful emesis attempt
• Large volume of stomach content
• Symptomatic patients with a large ingestion
  – Varies based on toxin
• Potentially life-threatening toxin

Contraindications
• Hydrocarbon ingestions
• Corrosives
• Recent surgery
• Unstable patients
• Patients at higher risk for bleeding or injury
• Inappropriate timeframe
• Liquid toxins: limited benefit

Decontamination methods: Gastric lavage

• Sedation, intubation, endotracheal insufflation
• Lateral recumbency with the head tilted down at an approximately 20° angle
• Measure tube to the last rib
• Flush 5-10 ml/kg warm water through a large-bore stomach tube
• Agitate stomach
• Aspirate or gravity drainage of stomach contents
• +/- Activated charcoal
  – Anti-emetic + Elevate head
  – Keep intubated until able to protect airway
Decontamination methods:
Gastric lavage

Photos courtesy of Dr. K. Peterson, VMD
Decontamination methods: Activated charcoal

- Activated charcoal has been called the most important “universal antidote” in the treatment of intoxication by chemical agents.

- Activated charcoal is produced by exposing the original material to an oxidizing gas compound of steam, oxygen, and acids at high temperatures (900°C).
- It results in the creation of a network of fine pores (10 to 20 nm in size) in the resulting charcoal.
- It is highly porous material with an enormous surface area relative to its weight.

- Adsorptive capacity of activated charcoal is a function of its binding surface area.
- Commercial products: surface area varies from 1000 to 2000 m²/gm.
- Adsorption of substances onto charcoal is a reversible process, with rapid adsorption and slow desorption, because substances bind to charcoal by weak covalent forces.
Decontamination methods: Activated charcoal

Benefits
- Readily available
- Relatively inexpensive
- Suspected to bind to most toxicants
- Even with delayed administration may ↓ absorption by 25-30%
- Can administer with food to encourage ingestion

Risks
- Unknown benefit
- 2 hour window for administration?
- Hypernatremia
- Difficulty of administration
- Messy
- Vomiting after administration
- Diarrhea/changes to stool
- Binds to therapeutic medications

Decontamination methods: Activated charcoal

- Known NOT to significantly adsorb a number of substances
  - Ammonia, borates and borax, bromide, fluoride, chlorates, cyanide, iodide, nitrates and nitrates, phosphorus, sodium chloride
  - Heavy metals: arsenic, copper, iron, lead, lithium
  - Corrosive and caustic chemicals
    - acids, alkalis, cationic detergents, paraquat, and disquat
  - Petroleum distillates (white spirit, kerosene, and xylene)
  - Small polar molecules
    - (alcohols, ethylene glycol, urea)
  - Metaldehyde
  - Camphor
  - Xylitol

- The binding of activated charcoal has not been tested against all (or even many) drugs and chemicals

Decontamination methods: Activated charcoal

Contraindications
- +/- Symptomatic
  - Neurologically inappropriate
- Dehydration
- Hypernatremia
- Hypovolemic shock
- Decreased GI motility/ileus
- Recent surgery
- Protracted vomiting
- Inappropriate timeframe
  - XR formula medications may still be valid
Decontamination methods: Activated charcoal

**Contraindications**
- Ingestion of a caustic substance or hydrocarbon
- ↑ post-pneumonia
- Endoscopy (obscure visualization)
- Abdominal surgery of the GIT
- Gastric or intestinal obstruction
- Risk for aspiration pneumonia
  - Unprotected airway
  - ↓ LOC
  - Excessive sedation/agitation
  - Forced feeding

Decontamination methods: Activated charcoal

**Dosage**
- Standard dose 1g/kg PO
- 1-5g/kg (Plumb's)
- Multi-dose
  - Repeat in 6-8 hours if ER formula medication
  - Repeat q 6-8 hours for 24 hours if enterohepatic recirculation occurs
  - Manufacturer suggests ½ the dosage, but gives no recommended dosing schedule

Decontamination methods: Activated charcoal

**UAA gel**
- Contains mixture of activated charcoal and clay
- 1/3 of administered amount is charcoal
- Clay is a poor adsorbent
- In general, not recommended due to increased volume needed
- Typically need to give 3x the recommended labeled dose for effectiveness
Decontamination methods: Cathartics

- Osmotic – draws water into GIT
- Accelerates speed of drug transit through GIT
- Decrease time for toxin absorption
- Decrease time for desorption of toxin from activated charcoal

Decontamination methods: Cathartics

**Sorbitol**
- Hexahydric sugar alcohol = osmotic cathartic
- Poorly absorbed from the gastrointestinal tract
- Metabolized by the liver and slowly converted to fructose
- Insulin is not necessary for intracellular transport of sorbitol
- Hyperosmotic cathartic, produces a hygroscopic action resulting in increased water in the large intestine and increased intraluminal pressure which stimulates catharsis
- Sorbitol does not compromise the adsorptive capacity of activated charcoal

Decontamination methods: Cathartics

**Sorbitol**
- Most rapid and potent cathartic
- 70% solution
- 1–3ml/kg PO
- Often in activated charcoal preparations
  - Dose animal based on activated charcoal amount
Decontamination methods: Cathartics

**Magnesium based**
- Increase serum and brain magnesium levels
- Magnesium hydroxide: Milk of Magnesia
  - 5-10mls PO q 8 hours for 24 hours
- Useful for mild iron toxicity
  - Precipitates iron in GIT into insoluble iron hydroxide

**Side effects**
- Hypermagnesemia
  - Hypotonia
  - ECG changes
  - Altered mental status
  - Increased brain magnesium levels
  - Respiratory failure
- Cautious use in cats
- Not recommended for bromethalin toxicity
  - May exacerbate or mimic toxicity signs

Decontamination methods: Whole bowel irrigation

**Indications**
- Enteric coated drugs
- Iron
- Sustained or extended release drugs
- Packets of drugs

Decontamination methods: Whole bowel irrigation

- NE or NG tube
- Polyethylene glycol
  - 25-40 ml/kg PO followed by a continuous oral infusion of 0.5 ml/kg per hour until radiographic clearance or clear effluent
Decontamination methods: Endoscopy and surgical removal

Endoscopy
• Coins
• Non-leaking batteries
  – Especially button batteries
• Patches
• Fentanyl, lidocaine
• Bottles/plastic
• Other metals
• Evaluate for injury to esophagus/stomach

Surgical removal
• Unable to remove endoscopically
  – Gorilla glue
  – Sharp objects
  – Large foreign bodies
  – Medication bezoars
  – Leaking batteries
  – Large number of objects
  – Bread dough
• Foreign body objects or large amounts of ingested toxins

Negatives
• May be delayed pending stability of patient
• General anesthesia
• Cost
• Accessibility of equipment
• Operators skill-Endoscopy
Decontamination methods

When selecting the most appropriate method(s) of decontamination for your patient, remember to consider:

- Exposure type
- Time frame since exposure
- Signalment of patient
- Indications and contraindications of decontamination for patient

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