

# Veterinary Toxicology: Approaching Pet Poisonings Correctly From the Start!

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## Today's goals

Discuss:

- Appropriate patient assessment
- Proper assessment of a poisoning
- Staff safety when handling symptomatic patients
- Most ideal drugs for poisoning management
- Common patient management needs
- General patient follow-up needs

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## POLL Question Dealing with a potentially poisoned patient is....

- ▶ Very stressful & I often don't know where to start
- ▶ Stressful but exciting & I often know what to do
- ▶ Manageable because I have a good grasp on toxicology
- ▶ Easy because my patients only ingest chocolate
- ▶ Easy because I call an animal poison control center for guidance

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## Patient & Poisoning assessment




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Much unhappiness has come into the world because of things left unsaid.

Fyodor Dostoevsky, Russian novelist

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### Questions to ask with toxin exposure:



- Is the patient stable?
- What is the signalment?
- Any current/past medical concerns and medications?
- What was the toxin and route of exposure?
- How much were they exposed to?
- How long ago did this occur?
- Where did the exposure occur?
- What other factors are involved?

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### Patient assessment

**Is the patient stable?**

- Assess vitals
- Current neurologic status
- Hydration status
- Lab results, if indicated

**Any current/past medical concerns?**

- Longstanding medical disease
  - Heart murmur
  - Diabetes
  - IMHA
- Recent illness or surgery
  - Spay/Neuter
  - Pancreatitis
- Current prescription and non-prescription medications





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### What is Patient's Signalment?

**Species**

- Species differences with toxicities
- Lilies
- Xylitol
- Long-Acting Anticoagulant
- Bromethalin
- Acetaminophen
- NSAIDs

**Breed**

- Brachycephalic breeds
- Increased risk with emesis
- ABCB1 (MDR-1) gene mutation risk
- Higher toxicity risk with certain drugs
- <http://vcpl.vetmed.wsu.edu/problem-drugs>
- Collie 70%, long-haired whippet 65%, Australian shepherd 50%








Photo: www.medicalnewstoday.com

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### Patient assessment



Age	Weight
<p>Age factors</p> <p>Hepatic function ↓ &lt;12wks of age</p> <p>Cardiac output more HR dependent in young animals</p> <p>Tachycardia vs bradycardia</p> <p>Potentially lower toxic dose for neonates or geriatric patients</p> <p>Renal compromise &amp; hepatic impairment in older patients</p>	<p>Difference between toxic and non-toxic ingestions is often a thin line</p> <p>Accurate weights needed to properly assess toxicity risk</p> <p>Decontamination preferences in large vs small breed</p> <p>Added risks/concerns with obesity?</p>



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### Poisoning assessment

#### What was the toxin?

Rodenticides	<ul style="list-style-type: none"> <li>Long-Acting Anticoagulant</li> <li>Bromethalin</li> <li>Cholecalciferol</li> <li>Corn cellulose</li> </ul>
Lilies	<ul style="list-style-type: none"> <li>Toxic lilies (<i>Lilium</i> &amp; <i>Hermercallis</i> sp.)</li> <li>Calla (<i>Zantedeschia</i> sp.) &amp; Peace lily (<i>Spathiphyllum</i> sp.)</li> <li>Peruvian (<i>Alstromeria</i> sp.)</li> <li>Lily of the Valley (<i>Convallaria</i> sp.)</li> </ul>
Gum	<ul style="list-style-type: none"> <li>Sugar-free does NOT mean xylitol</li> <li>Sugar alcohol does NOT mean xylitol</li> <li>Brand and flavor are important</li> </ul>










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### Poisoning assessment

What is the route of exposure?	What was the dose or amount exposed to?
<p>Exposure route affects toxicity concern</p> <p>Dermal, oral ocular, inhaled</p> <p>Liquid on the skin/hair</p> <p>Expansive glues</p> <p>Hydrocarbons</p> <p>Corrosives</p>	<p>Chewed medication container</p> <p>Full bottle/almost empty/size when new</p> <p>Baits</p> <p>1 block/1 pellet/1 bag/1 bucket</p> <p>Liquid ingestions</p> <p>Bowlful/few laps</p> <p>Diluted vs concentrated</p>

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### The Dose Makes the Poison

Paracelsus, (1493-1591) founder of toxicology




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## Poisoning assessment

**Time since exposure?**

Time frame is a large factor



- Rate of absorption
- Rapid/Immediate
- Regular
- ER/XR
- Effective decontamination methods
- When signs would be expected

**Where did the exposure occur?**

Address other potential confounding factors





Recognize potential severity differences

Agricultural/industrial concentrations vs. residential

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## Poisoning assessment









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graph TD
    A[Other factors to consider?] --> B[Extenuating circumstances]
    B --> C[Other animals involved]
    C --> D[Was the exposure accidental or malicious]
    D --> E[Other environmental factors]
    E --> A
  
```

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## Proper toxicity assessment

	Easier to assess when dealing with medications and foods	Strength Amount
	More difficult with chemicals	Read label & look for symbols or statements on containers
	Give little weight to expiration dates	Studies w/ various rodenticides, chemicals & medications → full potency years after exp. date

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## Poll question


An easy indicator of a chemical's potential risk is to:


- ▶ A) Look at the listed ingredients
- ▶ B) Look for signal words on the bottle
- ▶ C) Ask an associate at the store
- ▶ D) Call your neighbor


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## Reading chemical labels

**Caution or Warning**

 Indicates a mild hazard

 Permanent damage not likely as a result of accidental exposure if appropriate first aid is given

 Signal word usually found on cleaning products

 Many laundry/automatic dishwasher detergents, disinfectants & all-purpose cleaners

**KEEP OUT OF REACH OF CHILDREN**  
**CAUTION: HARMFUL IF SWALLOWED. SKIN AND EYE IRRITANT.**  
**DO NOT** ingest. Avoid contact with skin, eyes, mucous membranes and clothing. Contains Chlorine Bleach and Sodium Silicate. **DO NOT** mix with any other products such as dishwashing liquids, cleaning products or ammonia as harmful fumes may be generated. Not for handwashing.

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## Reading chemical labels


**Danger- Corrosive**

Indicates greater precaution should be taken

Often found on specialty products intended for rough jobs; oven cleaners/drain openers

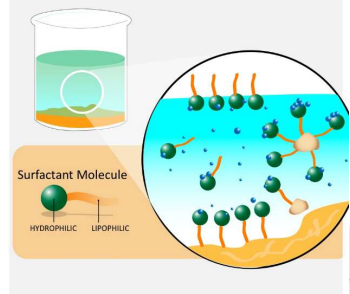
Accidental exposure to eye/skin or swallowing undiluted product could cause long-term damage

May be found on products that ignite if exposed to open flame



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## How Surfactants Work



## Assessing chemical toxicity: Surfactants

**Non-ionic**

- No charge, limited harm


**Anionic**

- Negatively charged, minor-moderate harm

**Cationic**

- Positively charged, greatest potential for harm
- Usually contain quaternary *ammonium* compounds
- Don't be fooled by neutral pH

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**Don't let their panic become your panic!!**

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### Ideal drugs for poisoning management

- DECONTAMINATION NEEDS
- NEUROLOGIC MANAGEMENT
- RENAL MANAGEMENT
- HEPATIC MANAGEMENT
- CARDIAC MANAGEMENT
- GASTROINTESTINAL MANAGEMENT

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### Poll Question

It is ideal to vomit anything that is ingested

- ▶ True
- ▶ False

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### Decontamination Needs: Types

- Ocular
- Dermal
- Inhalation
- Gastrointestinal

**CAUTION**  
**DOG VOMIT**

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### Ideal drugs: Decontamination

- Ocular**
  - Eye wash
  - Tap water
- Dermal**
  - Degreasing liquid dishwashing detergent
- Inhalation**
  - Oxygen

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## Ideal drugs: Decontamination

**Emetics**

**Apomorphine Dogs only:** 0.03 mg/kg IV/0.04 mg/kg IM

**Ropinirole (Clevor®) Dogs only:** Dose 2.7-5.4 mg/m<sup>2</sup> (avg 3.75 mg/m<sup>2</sup>)  
Reverse with metoclopramide

**3% Hydrogen peroxide Dogs only:** 1-2ml/kg (0.5-1tsp/10 lbs)  
GI protectants if overdose

**Xylazine (Rompun®) Cats only:** 0.44mg/kg IM  
Reverse with yohimbine

**Dexmedetomidine (Dexdomitor®) Cats only:** 7mcg/kg IM (5-10mcg/kg IM)  
Reverse with atipamezole

**Hydromorphone Cats only:** 0.1mg/kg SQ  
Reverse with naloxone




Photo: www2.zooetipet.com

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## Ideal drugs: Decontamination

**Activated charcoal +/- cathartic**

- Toxiban®, UAA Gel®, others
- 1-2g/kg PO
- Sorbitol: 1-3ml/kg PO
- Often in activated charcoal preparations

**Dose animal based on activated charcoal amount**



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## Cholestyramine

Useful for certain toxins that are excreted in bile & undergo enterohepatic recirculation, i.e., cholecalciferol, NSAIDs, sago palm, cyanobacteria (Microcystin)

Combines with bile acids → insoluble → limits reabsorption in GIT

0.3-1g/kg resin powder PO q 8 hrs x 3 days


Ensure no xylitol



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## Ideal drugs: Neurologic management

Agitation/Hyperactivity	Tremors
<p><b>Acepromazine</b> 0.05-0.1mg/kg IM, SQ, IV Up to 1mg/kg in severely affected animals (Amphetamines)</p> <p><b>Chlorpromazine</b> 0.5-1mg/kg IM, IV Up to 10mg/kg in severe cases</p> <p><b>Butorphanol</b> 0.2-0.4mg/kg IM, SQ, IV Cardiovascular sparing Ideal if hypotension/CV disease Ideal for short duration sedation Reverse with naloxone if needed</p>	<p><b>Methocarbamol</b> 55-220mg/kg IV, PO, Rectal slurry IV preferred</p> <p><b>Benzodiazepines?</b> Diazepam &amp; midazolam Often less effective May worsen neurologic signs Amphetamines SSRIs</p>



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### Ideal drugs: Neurologic management




Seizures	Cerebral edema
<p><b>Diazepam/Midazolam (Valium/Versed)</b> 0.5-1mg/kg IV to effect Avoid use in most toxicities with stimulatory effects i.e., amphetamines, methylphenidate, SSRI, SSNRI</p> <p><b>Phenobarbital</b> 3-4mg/kg IV to effect, up to 8mg/kg</p> <p><b>Levetiracetam (Keppra)</b> 30-60mg/kg IV to effect</p>	<p><b>Mannitol</b> 250-500mg/kg IV slowly over 20-30 minutes Repeat q 4-6 hours as needed Ensure patient is hydrated and stable before administering IV fluids should be discontinued during administration</p>

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### Ideal drugs: Renal management

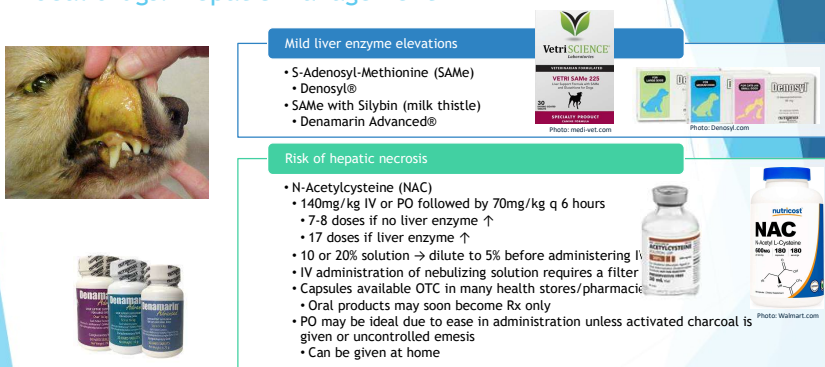
#### Fluid therapy



Crystalloids	Furosemide	Mannitol
<p>LRS 0.9%NaCl Norm-R</p>	<p>2-4mg/kg IV 0.3-1mg/kg/hr IV CRI</p>	<p>250-500mg/kg IV slowly over 20 minutes Up to 1-2g/kg IV</p>

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### Ideal drugs: Hepatic management



Mild liver enzyme elevations	Risk of hepatic necrosis
<ul style="list-style-type: none"> <li>• S-Adenosyl-Methionine (SAMe)</li> <li>• Denosyl®</li> <li>• SAME with Silybin (milk thistle)</li> <li>• Denamarin Advanced®</li> </ul>	<ul style="list-style-type: none"> <li>• N-Acetylcysteine (NAC)</li> <li>• 140mg/kg IV or PO followed by 70mg/kg q 6 hours</li> <li>• 7-8 doses if no liver enzyme ↑</li> <li>• 17 doses if liver enzyme ↑</li> <li>• 10 or 20% solution → dilute to 5% before administering IV</li> <li>• IV administration of nebulizing solution requires a filter</li> <li>• Capsules available OTC in many health stores/pharmacies</li> <li>• Oral products may soon become Rx only</li> <li>• PO may be ideal due to ease in administration unless activated charcoal is given or uncontrolled emesis</li> <li>• Can be given at home</li> </ul>

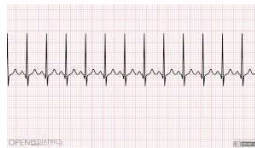
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### Ideal drugs: Cardiac management

#### Tachycardia

Treat if:  
>180 bpm dogs (>160 bpm large breed)  
>250 bpm cats

**\*Check BP first\***



Acepromazine	Butorphanol	Beta blockers
<ul style="list-style-type: none"> <li>• 0.05-0.1mg/kg IV, IM, SQ</li> <li>• Used in conjunction w/ agitation +/- hypertension</li> </ul>	<ul style="list-style-type: none"> <li>• 0.2-0.4mg/kg IV, IM, SQ</li> <li>• Used in conjunction w/ agitation +/- hypertension</li> </ul>	<ul style="list-style-type: none"> <li>• Esmolol</li> <li>• 0.25-0.5mg/kg IV over 1-2 mins followed by CRI at 0.01-0.2mg/kg/min</li> <li>• Propranolol</li> <li>• 0.02mg/kg IV over 2-3 mins. Repeat in 20 mins until effect is seen, up to 0.1mg/kg</li> <li>• Metoprolol</li> <li>• 5-50mg TOTAL PO divided q8-12 hours</li> </ul>

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## Ideal drugs: Cardiac management

### Bradycardia

Treat if:  
<40-50 bpm dogs  
<120 bpm cats

**\*Check BP first\***



### Atropine

- 0.02-0.04mg/kg IV

### Calcium gluconate 10%

- Reserved for calcium channel blocker poisoning
- 0.5-1.5ml/kg IV slowly followed by 0.25-0.35ml/kg/hr CRI
- Monitor ECG during administration

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## Ideal drugs: Cardiac management

### Hypertension

Treat if:  
Systolic >180 mmHg (Normal 120 mmHg)

MAP >130 mmHg (Normal 100mmHg)

### Acepromazine

- 0.02-0.1mg/kg IV, IM, SQ

### Calcium channel blocker

- Amlodipine
- Dogs 0.1-0.5mg/kg PO q 12-24 hrs
- Cats 0.625-0.125mg PER cat q 12-24 hrs
- May take several hours for full effect
- DO NOT give if bradycardic!

### Beta blocker

- Esmolol
- 0.25-0.5mg/kg IV over 2-5 mins followed by 10-200mcg/kg/min CRI
- Propranolol
- 0.02-0.1mg/kg IV q 8-12 hrs
- Oral
- Dogs 0.1-1.0mg/kg q 8-12 hrs
- Cats 0.25mg PER cat PO q 8-12 hrs

### Others / vasodilators

- Hydralazine, ACE inhibitors, isoflurane

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## Ideal drugs: Cardiac management

### Hypotension

Treat if:  
Systolic  $\leq$ 90 mmHg or  
MAP  $\leq$ 60 mmHg

### IV fluids

- Crystalloids 20ml/kg bolus over 10-15 mins
- Repeat 2-3x as needed
- Colloids (VetStarch) 5ml/kg bolus over 15 mins, up to 20ml/kg/day
- Repeat 2-3x as needed

### Vasopressors & Inotropes

- Dopamine, norepinephrine, dobutamine, vasopressin, epinephrine

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## Ideal drugs: Gastrointestinal management

### Anti-emetic



### Maropitant (Cerenia®)

- 1mg/kg SQ
- Dogs 2mg/kg PO
- Cats 1mg/kg PO (extra-label) SQ labeled for 5 days

### Metoclopramide (Reglan®)

- 0.2-0.5mg/kg q 6-8 hours SQ, SC, IM, PO
- 0.01-0.09mg/kg/hour CRI
- Extra-label in cats with same dosages

### Ondansetron (Zofran®)


- 0.1-0.2mg/kg q 12 hours IV
- 0.5-1mg/kg PO
- Extra-label for dogs & cats

### Dolasetron mesylate (Anzemet®)

- 0.6mg/kg q 24 hours IV, SQ, PO

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### Ideal drugs Gastrointestinal management: Gastroprotectants



**Sucralfate**

- 0.5-1g total q 8 hrs PO

**H2 blockers**

- Famotidine 0.5-1mg/kg q 12 hrs IM, SQ, IV, PO
- Cimetidine 5-10mg/kg q 6-8 hrs PO

**Proton pump inhibitors (PPI)**


- Omeprazole
  - 0.5-1mg/kg q 24 hrs PO
- Pantoprazole
  - 0.7-1mg/kg q 12 hrs IV

**PG E1 analog**

- Misoprostol
  - 3-5mcg/kg q 8 hrs PO
- Prolonged use → diarrhea
- Avoid handling if pregnant

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### Ideal drugs: Gastrointestinal management



Antidiarrheals

Metronidazole

Probiotics

Fiber


Bland diet

Potential ileus

Metoclopramide

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### Ideal drugs: Intralipid emulsion



Antidote for some fat-soluble toxins

Works as a "lipid sink" or "sponge", also myocardial energy source, improves cardiac function

LogD: Measure of lipophilicity  
Helps determine potential benefit

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### Ideal drugs: Intralipid emulsion

Antidote for fat-soluble toxins

Ivermectin/Moxidectin	Baclofen	Beta blockers
Calcium channel blockers	Lidocaine	Bupropion
Ibuprofen? Naproxen	Permethrin / Pyrethroids?	

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### Ideal drugs: Intralipid emulsion

Dedicated catheter needed for administration

Regular peripheral catheter




↓

Dosing: 20% emulsion

1.5-4ml/kg IV bolus over 1 min	Follow with 0.25ml/kg/min for 30-60 mins	Repeat boluses at 1.5ml/kg q 6 hrs	Serum lipemia should clear prior to additional dosing
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### Putting it together

-  Assess full patient & exposure history when determining therapy needs
-  Not all patients require the same therapy needs for the same toxin
-  Therapy is the same for many toxins; Treat symptomatically
-  Consider stocking drugs that are used more frequently & with a wide variety of toxins

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