



SAVING PETS' LIVES, 24 HOURS A DAY, 7 DAYS A WEEK
PET POISON HELPLINE

Overview of Rodenticide Classes and Therapy Needs

November 18, 2019

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The green "resource" widget contains downloadable presentation slides, instructions on how to download your CE certificate, a link to take our survey, and links to further information about Pet Poison Helpline.



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What is Pet Poison Helpline?

- **24/7 animal poison control center**
- **Veterinary & human expertise**
 - 20+ DVMs, 75+ CVTs
 - DABVT, DABT
 - DACVECC
 - DACVIM
 - 10 PharmDs
 - 2 MDs
- **Case fee of \$59 includes**
 - Unlimited consultation
 - Fax or email of case report
- **Educational center**
 - Free webinars (archived)
 - Tox tools
 - Wheel of Vomit
 - Pot of Poisons (toxic plants)
 - Textbook
 - iPhone app
 - Newsletters for vet professionals
 - Free resources for clinics
 - Videos
 - Electronic material
 - Clings

Email us for more information!

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Nationwide
is on your side

Pet Poison Helpline®
and Nationwide®

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Nationwide® & Pet Poison Helpline®
working together

Shared mission in highlighting
the importance of preparing
for accidents and poisonings in
small animals

Addressing the cost of veterinary care:
Nationwide® covers the \$59 Pet Poison Helpline® fee when an insured pet is brought in to your hospital for care

Enabling best medicine:
Pet owners with Nationwide® spend twice as much on their pets than those without pet insurance

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Complete confidence

- More than 35 years of experience protecting pets
- Pet insurance that offers more coverage than any other pet plan
- Pet insurance plans for every pet and every budget

Coverage includes:

- Accidents and injuries
- Chronic conditions
- Procedures and surgeries
- Common illnesses
- Hereditary conditions
- Holistic and alternative medicines
- Serious illnesses
- Diagnostics and imaging
- Wellness visits

Additional member perks

- 24/7 vet helpline for any pet question
- Fast electronic reimbursements
- Convenient mobile claim submissions
- Discounts and special offers on pet products

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Overview of Rodenticide Classes and Therapy Needs



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Today's Goals

- Review:
 - History and EPA regulations of rodenticides
 - Rodenticide packaging
 - Main classes of rodenticides
 - MOA, toxic dose, clinical signs and therapy needs





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Trivia Fun

- In 2019, the most common call PPH received regarding a potential rodenticide poisoning was for:
 - A: Anticoagulants (combined)
 - B: Bromethalin
 - C: Cholecalciferol
 - D: Zinc Phosphide



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Rodenticides through the years

Anticoagulant rodenticides

- 1st and 2nd generation anticoagulants
 - 1st generation
 - Moldy sweet clover poisoning in cattle (1921) → Dicoumarol → Coagulopathy
 - Synthesis of dicoumarol and Warfarin (4-hydroxy-coumarin derivative) at UW-Madison (Warfarin: ↑ duration and potency)
 - Warfarin introduced as a rodenticide in 1948
 - 2nd generation “Superwarfarins”
 - Newer anticoagulants developed due to ↑ warfarin resistance in rodents (1960s-80s)
 - Examples: Bromadiolone, brodifacoum




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Rodenticides through the years

- Bromethalin**
 - Discovered in the mid 1970s
 - Developed for use in warfarin resistant rodents
 - Neurotoxin
- Cholecalciferol**
 - First used as a rodenticide in 1984
 - Alternative to anticoagulants
 - Results in hypercalcemia




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Current EPA regulations

- Regulations for residential use
 - Block bait only (no pellets)
 - No 2nd generation anticoagulants
 - Bait stations mandatory
 - Max size: 1lb containers
- Permissible active ingredients
 - 1st generation anticoagulants and non-anticoagulants
 - Bromethalin
 - Cholecalciferol
 - Corn cellulose products
 - Zinc Phosphide
- No longer use
 - Bromadiolone, brodifacoum, difenacoum, difethialone





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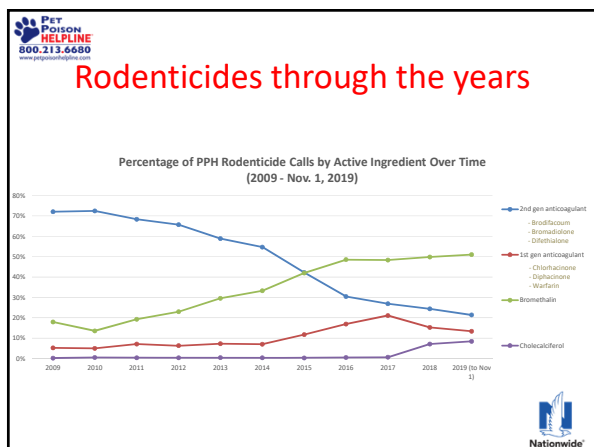
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Current EPA regulations

- Ag/Professional products
 - Only sold in ag store, tractor/farm equipment store Can purchase on internet sites, i.e. Amazon
 - For use in or around agricultural buildings
 - 2nd generation anticoagulants are allowed
 - >8 lb container
 - Non-anticoagulants allowed
 - >4 lb container
 - Blocks, pellets, meal and paste are allowed

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Rodenticides

- Anticoagulants
- Bromethalin
- Cholecalciferol
- Phosphides
- Strychnine
- Corn cellulose

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Anticoagulants

Warfarin 1st


Diphacinone 1st


Chlorphacinone 1st

Bromadiolone 2nd

Difethialone 2nd

Brodifacoum 2nd





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Anticoagulants

Supplied as:

- Hard blocks
- Pellets
- Soft bait
- Meal/Grain
- Powder
- Liquid






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Anticoagulants


- Mechanism of action
 - Inhibits vitamin K epoxide reductase
 - Needed to convert Vitamin K epoxide to the reduced form
 - Carboxylation & activation of factors II, VII, IX & X are dependent on reduced vitamin K ≠ synthesis
 - Clotting times remain normal for 12-36 hours until the natural decay of circulating factors occurs



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Anticoagulants



- Margin of Safety
 - Varies based on active ingredient
- Most narrow to widest margin
 - Brodifacoum
 - Diphacinone
 - Chlorphacinone
 - Difethialone
 - Bromadiolone
- Cats are very resistant to LAACs
- Relay toxicity is rare

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Anticoagulants

Well absorbed orally

Peak plasma levels within 12 hours

PT elevation seen 36-48 hours

Coagulopathy develops within 48-72 hours

Clinical signs develop as early as 48-72 hours, but often not until 5-7 days

T_{1/2} varies from 4-12 days

Warfarin T_{1/2} 12-18 hours

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Anticoagulants Clinical Signs

Lethargy

Pallor

Petechia/Ecchymosis

Increased respiratory rate or effort, dyspnea

Hemoptysis, epistaxis

Hematuria, hematochezia or melena

Hemorrhage to thoracic and/or abdominal cavity

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Anticoagulants








Photos courtesy of Dr. J Christie, DVM




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Anticoagulants-Therapy


 EMESIS EVEN SEVERAL HOURS OUT	 +/- ACTIVATED CHARCOAL	 PT 36-48 HOURS AFTER INGESTION	 VITAMIN K1 3-5MG/KG DIVIDED Q 12 HOURS FOR 21-30 DAYS	 PT 36-48 HOURS AFTER FINISHING MEDICATION
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Rodenticides Audience Poll



All rodenticide baits are color-coded based on the active ingredient.

- True
- False




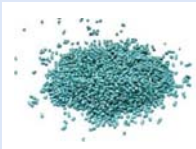

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Bromethalin

Supplied as:

- 0.01%
Hard block
Pellet
Soft bait
- 0.025%
Worm/Grub for gophers/moles




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Bromethalin



- Mechanism of action
 - Uncouples mitochondrial oxidative phosphorylation in the brain and liver mitochondria
 - Causes loss of sodium/potassium ATPase with resultant intracellular edema and degeneration
 - CNS most severely affected
 - Cerebral edema causes increased pressure on nerve axons, decreased nerve conduction → paralysis and death

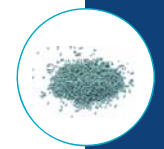
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Bromethalin

- Toxicity
 - LD50
 - Dogs 2.38-3.65mg/kg
 - Cats 0.54-1.8mg/kg
 - Cats VERY sensitive to toxicity
 - 0.01% bait contains 2.84mg bromethalin/ounce of bait
 - Peak plasma 4-6 hours
 - T_{1/2} several days
 - Primarily biliary excretion



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Bromethalin-Clinical Signs

>LD50 "Convulsant Syndrome"	<LD50 "Paralytic Syndrome"
<ul style="list-style-type: none">Onset of signs within 2-24 hoursLethargyAtaxiaTremorsSeizuresExtreme hyperexcitabilityCerebral edemaSigns may persist for days with therapySeizures seen less frequently in cats	<ul style="list-style-type: none">Signs delayed by 2-5 daysLethargyAtaxiaHind limb paresisHind limb paralysisSeizures as signs progressCerebral edemaSigns may persist for weeks

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Bromethalin



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Bromethalin Therapy

- No antidote
- Induce emesis even several hours after ingestion
- Anti-emetic
- Activated charcoal q 6-8 hours for 24 hours
 - *Enterohepatic recirculation
- IV fluids
- Monitor Na levels
- If cerebral edema develops
 - Mannitol
 - Elevate head 15-30°
- Methocarbamol for tremors
- Anticonvulsants
- ILE?

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Cholecalciferol

Supplied as a 0.075% bait

- Hard block
- Soft bait
- Pellet




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Cholecalciferol

- Mechanism of action
 - Promotes calcium retention
 - ↑ Ca and P absorption from the GIT
 - ↑ Ca reabsorption from the distal tubules
 - ↑ Ca mobilization from the bones
- Toxicity results in
 - Hypercalcemia (total serum calcium and iCa)
 - Hyperphosphatemia
 - Metastatic tissue calcification
- Enterohepatic recirculation occurs



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Cholecalciferol

Narrow margin of safety	Mild clinical signs	Hypercalcemia
0.06g finished bait/lb animal	0.1mg/kg cholecalciferol	0.5mg/kg cholecalciferol


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Cholecalciferol-Lab Findings

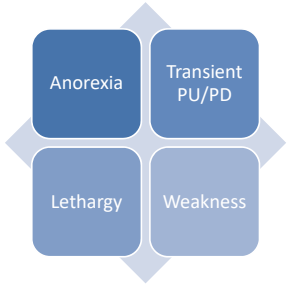
- Calcium and phosphorus levels rise 12-72 hours.
 - Healthy Adult Animals:
 - Serum calcium > 12.5 mg/dl
 - Ionized calcium > 1.33-1.4mmol/L or > 5.4 mg/dl
- Phosphorus level may increase 12 hours before serum calcium
- Elevations in BUN and creatinine, hyposthenuria
- Calcium-Phosphorus Solubility Index (CPSI)??
 - Soft tissue mineralization may occur when Ca x P > 60 in healthy adult animals
 - Use Ca x P cautiously as it may not be an effective indicator in acute toxicity situations
- Can be difficult to assess in growing animals




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Cholecalciferol Clinical Signs >0.1mg/kg






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Cholecalciferol
Clinical Signs
>0.5mg/kg

Signs generally develop within 12-36 hours

- 0-24 hours**
 - PU/PD, hypercalcemia, hyperphosphatemia, dehydration
- 12-36 hours**
 - Anorexia, vomiting, weakness, lethargy
- 24-48 hours**
 - Acute renal failure
- 3-5 days**
 - Depression, frank bloody diarrhea, hematuria, bradycardia, death



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Cholecalciferol Therapy >0.1mg/kg – 0.5mg/kg

Induce emesis

Activated charcoal with cathartic x 1

Sub q fluids


Baseline labwork
• Ca/P
• Renal values
• PCV/TS




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Cholecalciferol Therapy >0.5mg/kg

- Emesis**
 - Up to several hours out
- Anti-emetic**
- Multi-dose activated charcoal q 6-8 hours x 24 hours**
- Cholestyramine**
 - Limited data in animals but may be helpful
 - 0.3-1g/kg q 8 hours x 4 days given between charcoal doses
 - Base dose on amount of cholecalciferol ingested
- Baseline labwork**
 - CBC, Chemistry, iCa, UA
- IVF 0.9% NaCl 2-2.5x maint**
 - Increase calciuresis, prevent dehydration
 - Minimize risk of hypernatremia



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Cholecalciferol Therapy >0.5mg/kg

- Recheck Ca, P, PCV/TP and weight daily for 72 hours**
- Consider iCa vs total Ca**
- Calcium/Phosphorus elevations**
- Increase calcium excretion**
 - Prednisone 1mg/kg PO q 12 hours
 - Furosemide 1-2mg/kg q 12 hours PO *Worsens dehydration, less commonly used*
- Phosphate binders**
 - Aluminum hydroxide
- GI protectants if uremia occurs**




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Cholecalciferol Therapy

>0.5mg/kg

Bisphosphonates *Ideal therapy for hyperCa⁺⁺*

- Decrease serum calcium
 - Inhibit dissolution of calcium hydroxyapatite
 - Inhibit osteoclastic bone resorption
 - Decrease activity of 1-alpha-hydroxylase
- Pamidronate
 - 1.3-2ml/kg IV (diluted in 150-250ml 0.9% NaCl) given over 2-4 hours
 - Decrease in serum calcium in 24-48 hours
 - Repeat in 5-7 days if not responsive or severe rebound



Salmon calcitonin


- Expensive, hard to find and less effective
- Rarely recommended

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Cholecalciferol Therapy




Wean off medications slowly



25% decrease q 3 days only if Ca/P levels remain normal



Generally wean furosemide more rapidly, if used, to minimize dehydration




Treat chronic renal disease if needed

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Phosphides




- Types:
 - Often 2%, but concentration can vary
 - Pellets
 - Sugar baits
 - Underground stakes
 - Meal
 - Powder
 - Zinc phosphide commonly used in gopher bait "peanuts"
- MOA:
 - Create phosphine gas in acidic stomach environment
 - Gas smells like garlic or rotten eggs
- Toxic dose:
 - LD50 in dogs: 20-50mg/kg

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Phosphides



Clinical Signs: Seen as early as 15 minutes after ingestion	Treatment:
<ul style="list-style-type: none">• Vomiting• Lethargy or agitation• Diarrhea• Bloat• Tremors• Tachypnea• Seizure• Pulmonary edema	<ul style="list-style-type: none">• Liquid antacid – Magnesium or aluminum hydroxide, limits phosphine gas production• Induce emesis in well-ventilated area• Activated charcoal with cathartic x 1• IV fluids as needed for dehydration• Continue antacids while in clinic• Anti-emetic• Symptomatic and supportive care as needed



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Corn Cellulose/Corn Gluten Meal

- Corn based product
- Designed to cause dehydration and GI obstruction in rodents
- No toxicity concern in dogs or cats





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Strychnine

- Available as restricted use only in most states
- Underground application
- Rare to see exposure
- Rapid onset
 - Muscle spasm
 - Extensor rigidity
 - Tetanic seizures
- Symptomatic and supportive care



Strychnine laced hamburger to poisoned dogs in southern CA






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What's New with Rodenticides?

- EPA statement released October 2019
 - Considering registration for **alphachloralose**
- CNS stimulant and depressant
 - Significant, fatal hypothermia
 - Bradycardia and ↓RR
 - Excitement, depression, seizures, coma, death
- Used in the UK and other countries
- Supplied as a paste and placed in a tamper-resistant bait station





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Alphachloralose


- Comment submitted to EPA regarding safety
- www.regulations.gov
 - Search alphachloralose

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Conclusion



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    graph TD
      A[Not all rodenticides are anticoagulants] --> B[The main classes of rodenticides include]
      B --- C[Anticoagulants]
      B --- D[Bromethalin]
      B --- E[Cholecalciferol]
      C --> F[Bait color and type do not always help narrow down the active ingredient]
      F --> G[If an unknown type of bait is ingested, address decontamination and therapy that would cover the most common types]
  
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2nd Edition

Dr. Lynn Hovda, Ahna Brutlag, Robert Poppenga, Katherine Peterson

- Provides concise, bulleted information focused on the most important facts needed when treating a poisoned cat or dog
- Carefully organized for ease of use in an emergency, with important toxicants arranged alphabetically within categories
- Details clinically relevant information on the most common toxicants encountered by small animals
- Presents a wealth of color photographs to aid in plant identification
- Includes 14 new topics to this edition covering cyclosporine A, sleep aids, tacrolimus, bath salts, synthetic marijuana, poisonous lizards, imidacloprid, spring bulbs, and sodium monofluoroacetate

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2020 Webinars Announced

- **February 2nd**
 - Essential Oils
- **April 7th**
 - Warm Weather Toxins. A Short Review
 - Timely Woes.
- **June 2nd**
 - Hot Topic TBD
- **October 6th**
 - Worst of the Worst. Evaluating the Most Dangerous Toxins for Pets.
- **November 10th**
 - Hot Topic TBD




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Thank you for attending!

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2. **I attended the webinar but wasn't the person who logged in. Can I still get interactive CE credit?** Yes. Send your name and email address to info@petpoisonhelpline.com by **1pm central time on Nov. 19, 2019** (strict deadline).
3. **Can I watch the recorded webinar online for CE credit?** Yes. You can receive non-interactive CE credit. Go to the "For Vets" page on our website, www.petpoisonhelpline.com for more info.

Comments? Questions? Email us! info@petpoisonhelpline.com

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