Your Dog Ate What?! Managing Common Toxicities

Program Description: Toxicities are commonly encountered in both the emergency room and general practice. This program will review the general approach to toxicities as well as treatment and monitoring of specific, commonly encountered toxins.

Learning Objectives:
After the completion of this webinar, veterinary care professionals will be able to:

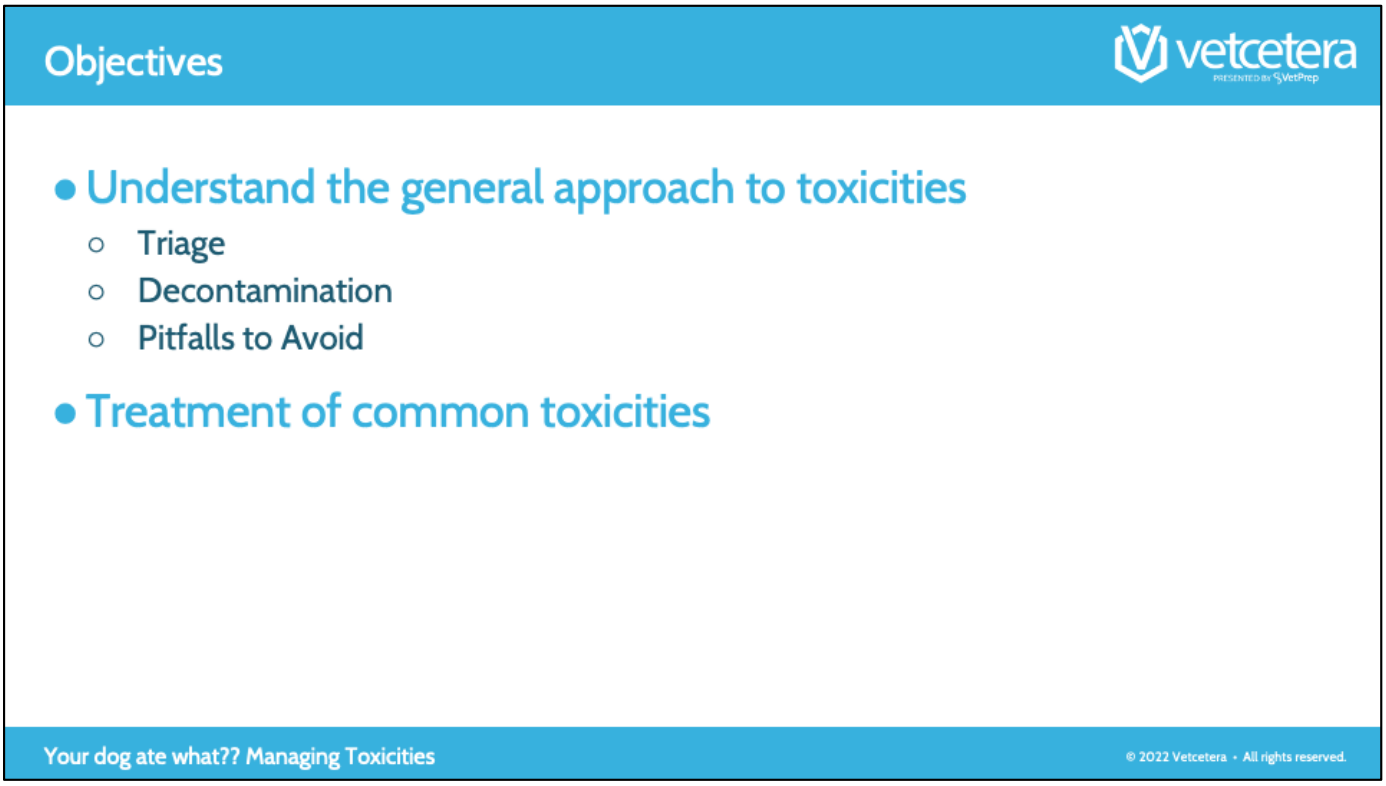
1. Review general approach to toxicity cases, both confirmed and suspected.
2. Review treatment of common toxicities

Good evening, everyone. Thank you so much for joining us tonight. My name is Katie Krothapalli. I'm the director of health care education for Vetcetera. Our speaker tonight is Dr. Lenore Bacek, and she is a board certified criticalist. I actually had the pleasure of getting to know her when I was at Auburn, and now she is at BluePearl with their emergency service. And she's doing great things. We love having her. She's a fantastic presenter. And I'll turn it over to her.

Thanks, Katie. Well, thanks for having me tonight. I always enjoy doing these talks. If you guys have been to my talks before, I really love when people put stuff in the chat to make it a little interactive. I know it's really challenging doing webinars and keeping everybody engaged, so there's a few cases at the end that we'll go through. But certainly, if people have questions or comments about different toxicities they've seen, throw it in the chat, and I'll see it on the side.

But really, the goal, like I said, there's a few cases at the end. The first half of the talk is really how to approach these cases when they come in. I think sometimes we're really lucky in the way that owners may have seen what did the dog eat, when did they eat it, and they have that information. And then other times, it's a little bit more of a mystery.

My own personal example, when I was studying for critical care boards, I had three dogs. I came home, and there was a bottle of Advil strewn about my living room. I did not know who ate it or how much was in. So I kind of had to approach it as assuming everyone ate a toxic dose so, really, just thinking through these cases and the basic principles.



So let's see. There we go. So we'll go through just the general approach-- approach, excuse me, to toxicities, triaging these cases, decontaminating them, and then, some again, just general pitfalls to avoid with toxicities. And then I tried to pick-- I think everyone probably sees a little bit of a different group of cases. I tried to pick things that I felt were common.

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General approach

- Treat life threatening problem
- Obtain history/physical exam/database
- Eliminate further exposure
- Promote excretion or metabolism
- Administer antidote (if available)
- Provide supportive care

https://commons.wikimedia.org/wiki/File:About_The_Dog.jpg

So general approach-- so for all these cases, it's going to be triaging anything that comes in emergency and treating the life-threatening problem. So if something comes in seizuring, if something comes in respiratory distress, We're going to want to treat those things first. And then for toxicities-- for any emergency case, obviously, history is important, but for these cases, it's really important to figure out what did they eat, when did they eat it. Do they know how much it was? Did the owner do anything at home? And then get whatever minimum database you feel like will be important for that case, whether it's a full CBC chem, whether it's just maybe a PCV, or no minimum database other than your physical.

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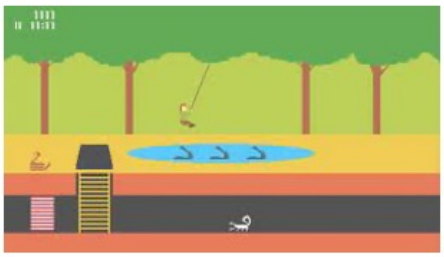
TRIAGE

- As with any emergency presentation, ABC's
- Life threatening problems may include respiratory difficulty, shock, seizures, arrhythmias
  - These should be treated immediately



https://www.ovrs.com/blog/the-pet-owners-guide-to-triage-and-the-veterinary-emergency-room

So for triage, I don't know if this dates myself, but the bottom left picture, if anyone recognizes, that it's from the video game Pitfall! from like the mid-1980s. But with any emergency presentation, we'll go through our ABCs. A lot of owners will call, and they'll really want to do something at home. And we'll talk a little bit about risks and benefits of hydrogen peroxide and other things owners can do.

But I think everyone has probably seen a case where the owner read on the internet that milk or something treats whatever the dog got into. We try to limit what owners do at home and have them come in as soon as possible. And then again, life-threatening problems, including respiratory difficulty, shock, seizures, anything like that should be treated immediately.

Whoops. And then for history-- so I'm a criticalist. I'm not the most patient person. I don't-- I'll admit it fully. I don't always get an internal medicine depth of history. I really want to know what's relevant to this emergency visit, so I want to know, what do they eat? What's the active ingredient? So best-case scenario, the owner can bring in the packaging, the bottle, the box, something that has the active ingredient.

And it's also really helpful to know, is it extended release? Or is it something-- just the regular version? I usually try to re-verify the ingredient. When we talk about rodenticide a little bit later, a lot of those names to me sound very, very similar, and I really want to know, is this a vitamin K antagonist? Or is this a neurotoxic rodenticide like bromethalin? And the owners may get confused. So certainly, having the packaging is going to be helpful.

When-- we're not always going to have the exact time frame if the owners were out of the house for a few hours, but certainly, trying to figure out a time frame. And then same thing with how much-- when my dogs got into the Advil, I had no idea how many exact pills were in there. But I could probably tell you a minimum and a maximum. I knew it wasn't a full bottle. I knew it wasn't an empty bottle. There was probably somewhere around half.

Have they had any clinical signs since ingesting the toxin? And then have they given them anything at home? And I think a major pitfall is not asking all these questions. So really, wanting to know, have they done anything and they just haven't told you and, then again, what exactly have they eaten, if they can tell you specifically. And if you don't know what

the drug is, I love the pet poison line or ASPCA.

There's a lot of really new fancy human drugs on the market that we don't typically use in vet med. So if there's something I'm uncomfortable with, I'm just going to tell the owner that's going to be part of the workup. We're going to call and get the advice of whoever is on the other side of that call just so we know exactly what we're dealing with.

Eliminating further exposure

- Bathing the pet if topical exposure
  - i.e. permethrins in cats
- For ingested toxins
  - **Emesis**, charcoal, gastric lavage

https://thepethospitals.com/vomitingdogorcat/

https://www.preventivevet.com/cats/giving-a-cat-a-bath-why-and-how

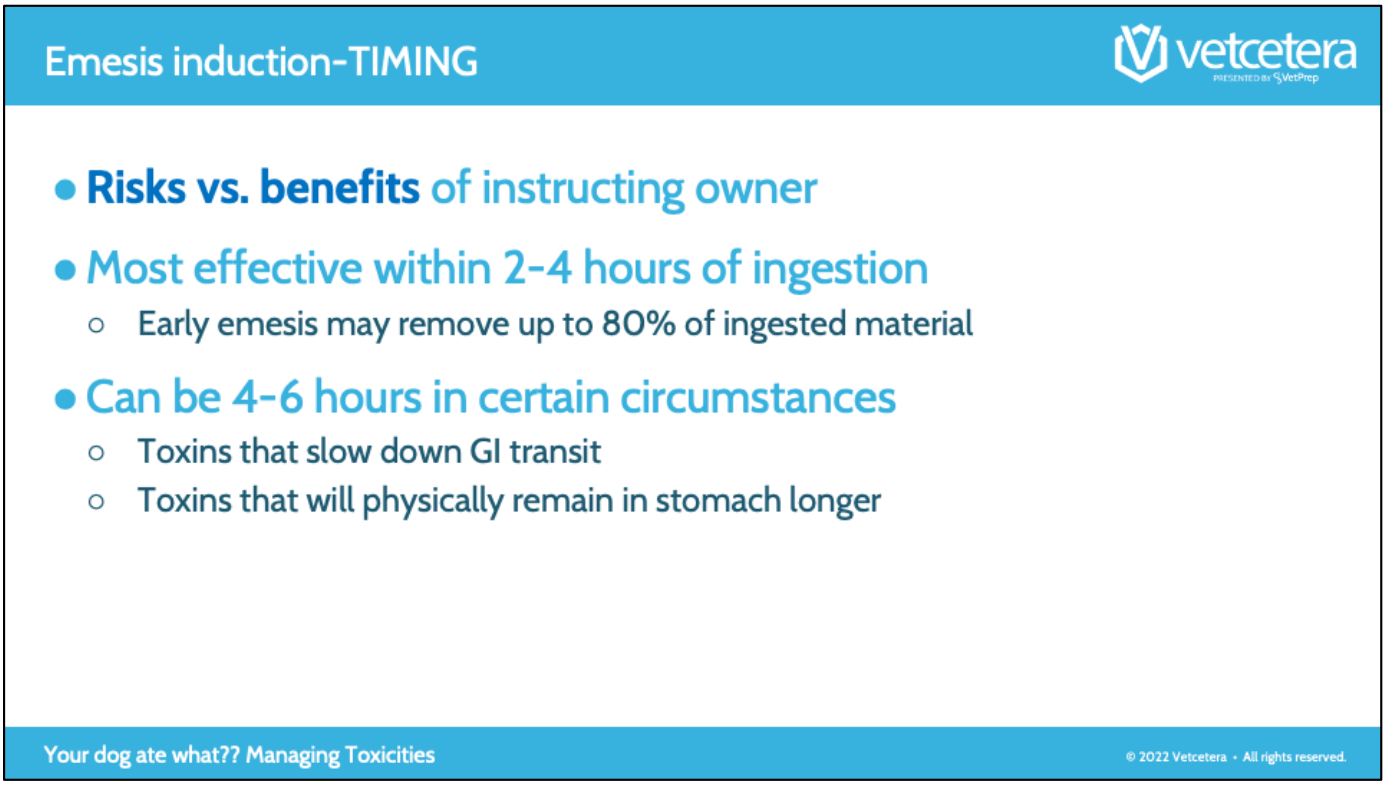
For eliminating further exposure, certainly, if it's something topical-- so I think the big example would be owners that buy over-the-counter flea and tick meds and put them on their cats and they contain permethrins. We want to try to bathe if it's a topical application. If it's something that maybe got in the eyes, you know, rinsing out the eyes. And then for ingested toxins, we're really going to focus on inducing emesis charcoal and gastric lavage. GI decontamination is probably the best treatment we have for a lot of these toxins if we can see them in a relatively short time frame. They are going to become less effective as time goes on, so time is really important for these cases.

Surface decontamination

- Skin/hair
  - Clip hair
  - Mild detergent
  - Lavage open lesions with saline
- Eyes
  - Rinse with water or saline

https://dawn-dish.com/en-us/products/dawn-ultra

For skin and hair sometimes, I'll clip the hair, depending on what the breed is, but a lot of the times, I'll just give a bath with a mild detergent like Dawn with the little ducks on it. If it's safe for ducks, it's safe for cats. Lavage any open lesions with saline. And then, again, if it's something that's been in the eyes, trying to rinse the eyes out with water saline. And we want to do this really copiously so we get out any toxin that's on the skin, any toxin that's in the eyes, and really stop any more absorption and exposure from that point forward.



One of the big things is going to be the timing of inducing vomiting. So again, I think a lot of owners will call and say, my dog just ate blah, blah, blah. I want to give hydrogen peroxide. How much do I have to give? And we try not to give out a lot of medication information over the phone, but there are definitely cases where the risk versus the benefit is going to become very important.

So for me, if it's a really quickly absorbed toxin and the owner lives five hours from the nearest vet clinic, to me, the risk of peroxide is probably worth it because the risk of that toxin being absorbed is probably going to be worse. We know that most of the drugs that we use are going to be effective within the first two to four hours of ingestion, so we really want to catch these cases quickly. Even if they present and they're very, very stable, they should be seen as stat triages or close to that to really be able to treat them effectively, remove as much toxin as we can.

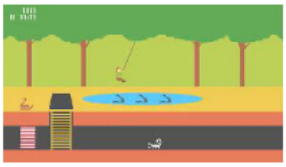
If I see a case, that's four or six hours out, I'll probably still go ahead and induce vomiting and give an emetic agent, especially if I know it's a toxin that's slowed down the GI transit or something that maybe physically will remain in the stomach longer. The big thing is really going to be thinking about, is this a case where there's a major contraindication to vomiting? So is this an animal that is already super bradycardic or neurologic? Is it something that already is in respiratory distress? Is it something really caustic that I don't want to have it come back up and cause more chemical burns or more irritation?

So those are usually the things I think about before I induce emesis. But otherwise, I'll

usually do it within the first two to six hours.

Emesis induction-CONTRAINDICATIONS

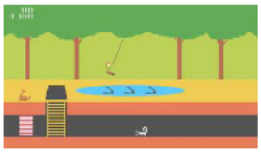
- Contraindication
  - Corrosive/caustic materials
  - Depressed/seizure animals
  - Bradycardia
  - Respiratory distress/decreased gag
  - Profuse vomiting
  - Certain breeds



And then contraindications, like I just mentioned, would be these things-- if they come in and they're already vomiting, we probably don't have to give them something else that causes vomiting. Certain breeds-- apologies in advance if anyone has a brachiocephalic, but they always make me nervous in general. But certainly, to induce vomiting, are they going to aspirate? And then that becomes their major problem, so just thinking about, again, like, is this a case where I could potentially make it worse if I make them vomit?

Emesis

- Options for dogs
  - Hydrogen peroxide (at home option)
  - Apomorphine
  - Ropinirole (Clevor)
- Options for cats
  - Dexmedetomidine
  - Hydromorphone



And then there's a few options for dogs and a few options for cats. The lists don't really cross over. So for dogs, this is not in the order I would use them, but these are kind of the common things. So for me, peroxide is an at-home option. I don't use that in the hospital.

Historically, I've used apomorphine. I don't know if people have any experience with Clevor. It's a relatively new emetic drug that we'll talk about. And then for cats, I think, historically-- luckily, cats don't get toxicities nearly as much because they're much smarter than dogs. But historically, I've used a lot of xylazine, and then as we stopped kind of carrying xylazine in a small animal hospital, I transitioned over to dexmedetomidine, or hydro. And again, luckily, I would say most of our toxin cases are silly labs that come in that just decided to eat the entire bag of chocolate that the owner brought home for Easter, but certainly, there are different options for dogs versus cats.

Hydrogen peroxide (3%) – at home option

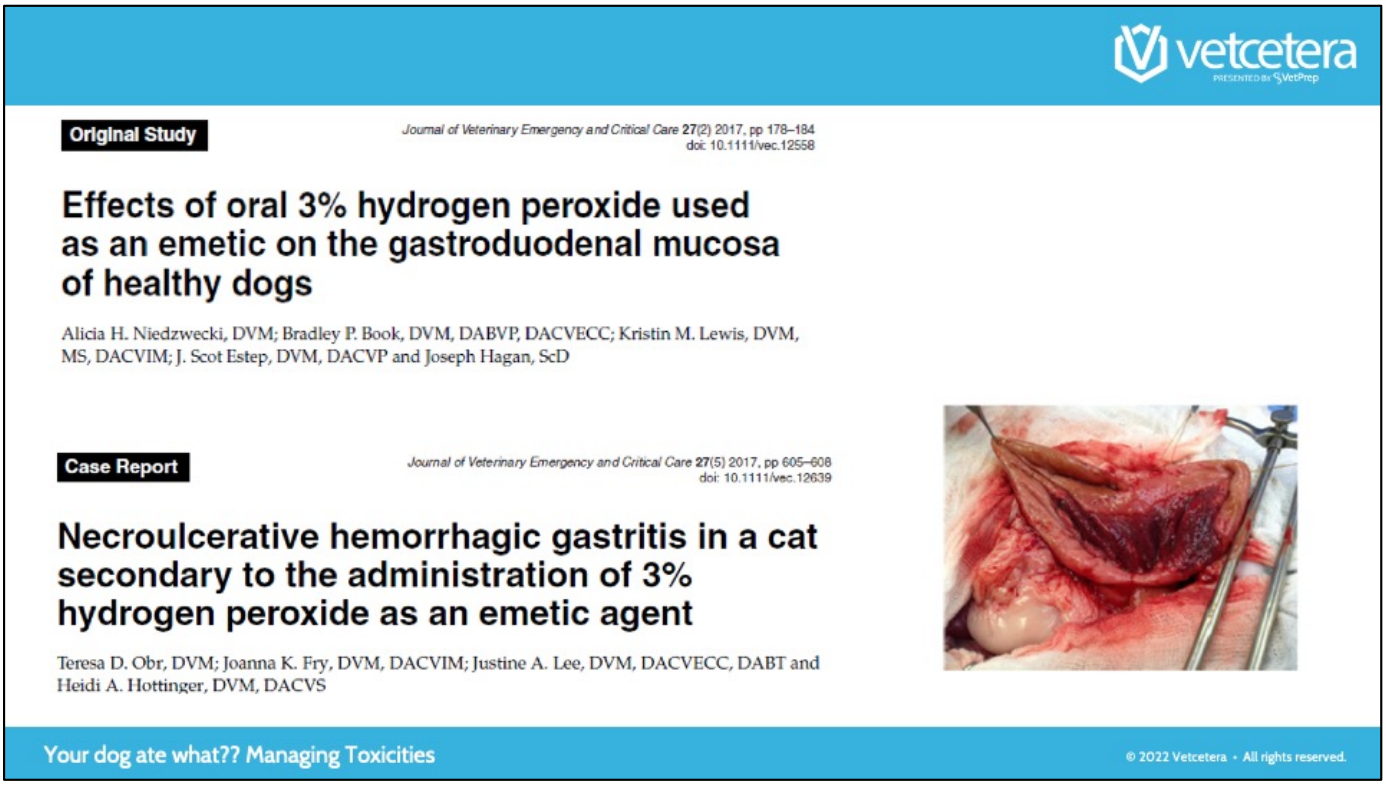
- Use **3% solution** to avoid severe mucosal irritation
- Induces emesis by local gastric irritation
- 1 teaspoon/5 lbs.
  - Do not exceed 3 tablespoons
- NOT IN CATS

https://www.target.com/p/hydrogen-peroxide-topical-solution-usp-32oz-up-38-up-8482/-/A-15115908

So for me, again, peroxide is going to be an at-home option. So peroxide causes severe, severe mucosal irritation. The nice thing is it's very cheap, and if the owner is far away from an emergency clinic, they can do this at home so, again, really thinking about the risk versus benefit. It's going to cause local gastric irritation, and it's going to work really, really fast. So if it's going to work, it's going to be within a couple of minutes.

We really want to give the owner, though, some parameters about how much to give. I've heard horror stories of owners kind of just taking the bottle and pouring it down the dog's throat or soaking pieces of bread in excessive amounts, so really thinking about-- the owner is not going to understand if I tell them to give 15 mLs, they're probably not going to have a way to measure that, so breaking it down into teaspoons or tablespoons. And really, no matter the size of the patient, I'm not going to go over three tablespoons.

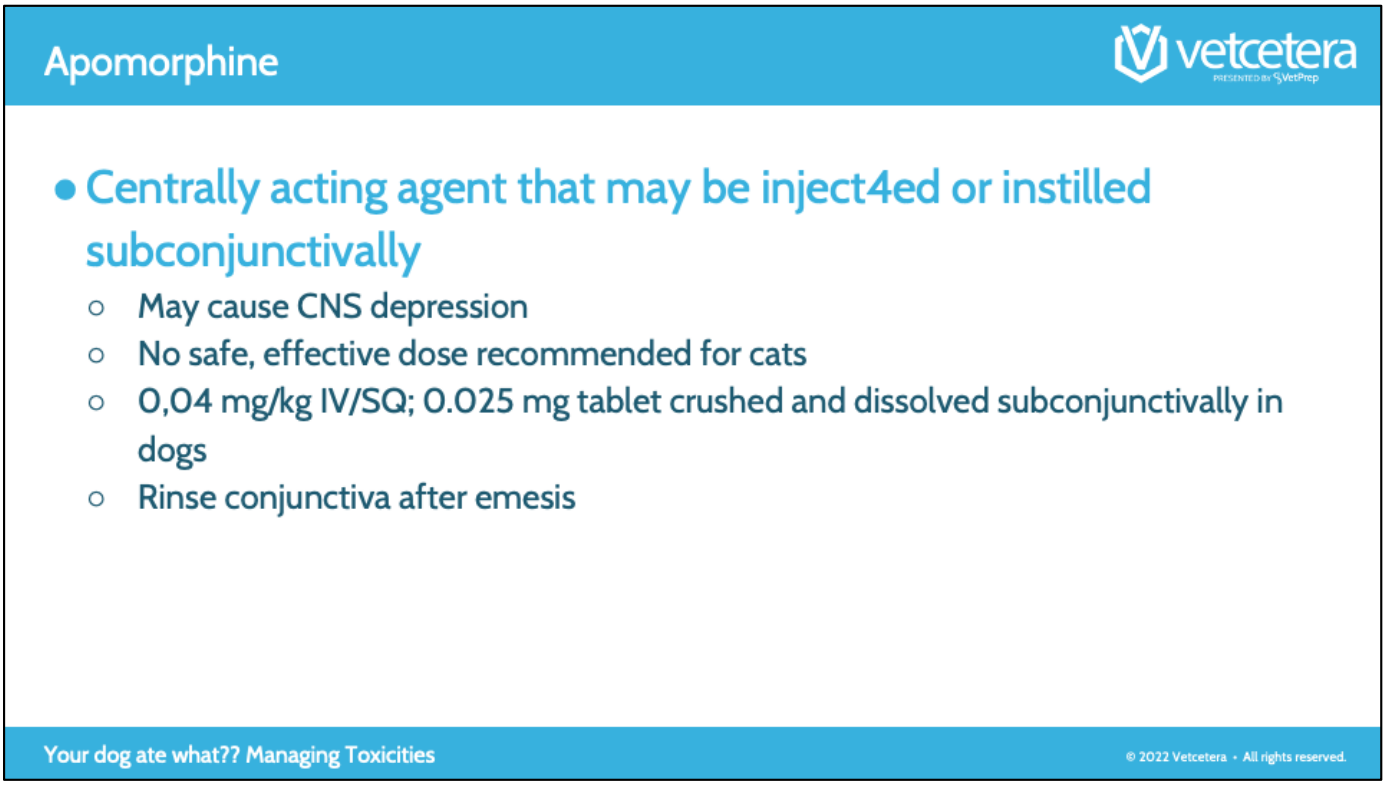
And then I don't use peroxide in cats. And other things I try to tell owners not to do are things like table salt or anything else that's kind of an older version or something maybe they used on their children or something else that may be available that's supposed to induce vomiting. So peroxide is the one thing. Making sure it's the 3% over the counter, so they do sell a much stronger version of peroxide for cleaning and other uses, but it will cause catastrophic mucosal injury to the point where they can actually perforate from that, so really verifying how much they're going to give and then what solution they have at home.



There's a couple-- I'll say in quotes-- horror stories or whatever you want to say, but this top paper is just looking at healthy dogs that they gave peroxide to. And then they scope them. And they all had pretty significant ulcerations in the stomach and in the duodenum, and these were healthy dogs. And they were just given peroxide. They weren't given it repeatedly. It was just that one time.

And then this is a cat-- this bottom case is a case report of a cat that basically a piece of foam or something pretty benign, was given peroxide at home, and the owner gave a pretty significant amount. And when the cat came in, it was vomiting basically constantly, and there was haemodialysis. And the cat wasn't doing well, So. They decided to explore it. And when they explored it, there was about 60% to 75% of the stomach that was completely ulcerated, and the cat ended up getting euthanized due to the severity.

So again, it's not contraindicated, but I think it's really a thoughtful decision. It's not-- I don't think it's a benign drug. I think we have to be thoughtful about when we're recommending it and if there's a better option and the owner can come in, that's probably going to be safer. So we can observe the dog vomiting. We can make sure there's no side effects from either the toxin or the emetic drug. We can make sure they don't have a vagal event or aspirate or anything like that. So I typically reserve peroxide for those cases where I feel like it's really, really important that the vomit happens soon.



I've used a lot of apomorphine. I've been, I would say relatively, happy with it. I was spoiled and was able to get the IV a lot of times, which is nice. I always hated crushing it and giving it subconjunctivally just because they always got, obviously, very irritated red eyes. But it's, essentially, acting emetic agent that, really, I would say pretty reliably in dogs causes vomiting pretty quickly, so within about 10 to 15 minutes. It can cause CNS depression, so they always look really sad if they vomit because they're a little bit sedated.

There's not a safer, effective dose in cats. It's really unreliable, and it's not something I typically will use in cats. The IV dose and subcu dose are the same. You can actually do it IM as well. If you're doing it in the conjunctiva, you basically are just crushing a tablet and giving it that way. If you're giving it in the eye, just making sure you're rinsing the eye out after they vomit because it can be quite irritating with the tablet is still in the eye.

And I just saw a few questions in the chat. So for subcu, it's going to take a little bit longer, so usually more on the 15 to 20 minute side. If they don't vomit within about 25 to 30 minutes, I'll usually repeat the dose if it was subcu or IM. And then there's a case-- let's see, I had a THC dog that was classic. Owner denied. I was going to make it vomit but only had Clevor and said not to use in CNS depression, and the dog was charcoal and monitored.

Yeah, so that's a good question. So how depressed do they have to be to not induce vomiting? So I think that's a subjective judgment call. So for me, I want to make sure if they vomit, obviously, like you said, they have a good gag reflex and that they're aware

enough that they know they're vomiting. So if they're walking around and they're just a little bit depressed, I think it's totally reasonable. If they're not walking, if they're stuporous and they're not very responsive, even if they have a gag, that would probably be a case I wouldn't do it.

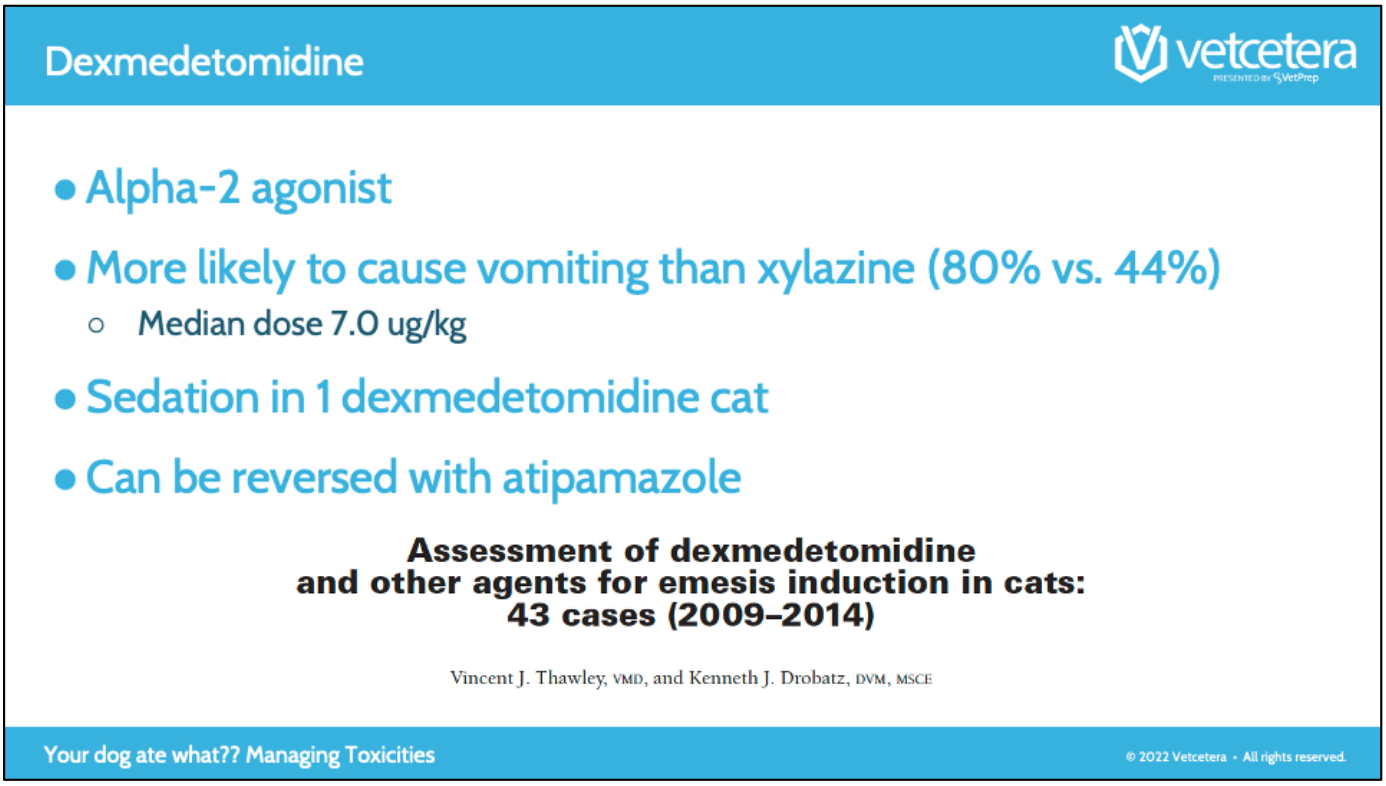
It's funny to me that owners still deny THC because it really is legal in so many places that it just seems like a silly thing to not just admit. And then a question about onion and garlic-- do you have a specific question that you want to throw in the chat? I'll keep going, and if there's a specific question about onion and garlic--

and then Clevor is a very, very new drug that just came out, I would say, within the last maybe six to 12 months.

It's a selective dopamine agonist. It's FDA approved. And it's just eye drops dosed based on body weight. They have a bunch of data on their website. I haven't actually used this in a clinic setting, but they're saying their mean onset of vomiting is about 12 minutes. And after dosing, they usually vomit about four to five times, and 95% of dogs vomit within one dose and within about 30 minutes.

Oh, OK, someone has found Clevor not very effective, and it has taken hours and still haven't been able to induce. So we switched back to apo. That's really interesting and maybe worth shooting a message to the-- I don't know who makes Clevor. I can't read this the small print on that box. But maybe worth shooting them an email. Maybe it was like a bad batch or something.

But I haven't used it personally. I had heard promising things, but that's really interesting to hear. They're touting it as being very, very safe and not having a lot of adverse effects. So some ocular effects potentially and then lethargy. Huh, that's interesting, so Clevor takes too long. Good to know. Thanks.



And then so for dogs, again, I'm usually in the hospital. I'm going to be using apomorphine. If people have good experiences with Clevor, obviously, that's an option, too. For cats I'm usually picking between dexmedetomidine and hydromorphone. So dex med, obviously an alpha 2 agonist. There was a study comparing dex med to xylazine because again historically I think we used a lot of xylazine. And dex med's actually more likely to cause vomiting. So about 80% compared to 44% with a median dose of about seven mics per kg The one cat out of the group-- I think there was about 40 cats-- got sedate. The nice thing is you can reverse it. So after they vomit, you can reverse it if they're too sedate.

And in this little study they gave three of the cats hydrogen peroxide and none of them vomited. So it sounds like a few people have a good experience with Clevor. Some people don't. So I guess try it if you have access to it. And if you don't like it, there's always apo.

Hydromorphone

- Comparing hydromorphone (0.1 mg/kg IV) vs. dexmedetomidine (7 ug/kg IM) in cats
- Effective alternative (75% vs. 58%)
- Hydromorphone □ less sedation, less decrease in heart rate

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ORIGINAL STUDY

WILEY

Assessment of hydromorphone and dexmedetomidine for emesis induction in cats

Michael R. Nystrom DVM[1] | Adesola Odunayo DVM, MS, DACVECC[1] | Chika C. Okafor DVM, MS, PhD, DACVPM[2]

And then the other drug in cats that I use is hydromorphone at a dose of about 0.1 mics per kg IV. So this is just a quick study where they looked at those two drugs compared to see if they were relatively similar in terms of efficacy. And what they found. It was a really reasonable effective alternative. So 75% of cats vomited with hydro versus 58% with dex med. And they were less sedate and had a less decrease in heart rate.

So again, if you don't carry xylazine, if you're a 100% small animal clinic, you might not. So other drugs like dex med and hydro that we should have access to. And this is in healthy purpose bred cats. So certainly in sick cats, maybe the outcome will be different. I've used Dex Med. I haven't been super impressed with it. I think luckily again, cats seem to be a little bit smarter and don't tend to come in quite as often with toxicities, which is nice.

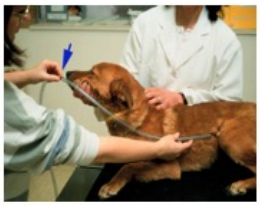
How many times will you comfortably give apo to a dog that still has pharmaterial in the stomach on rad, same dose every time. So I've found that after two doses, if it's not going to work, it's not going to work. So at that point, either trying a different drug or maybe like endoscopy if it's something that you're not getting out with a nomadic emetic agent. I feel like after that second dose, though, most of the time they will vomit.

And then let's see, I use 50 mics dex med in cats, and spin them. I only see about 15% vomit and 100% have sedation. Am I going too high? So they're using seven mics per kg. So you figure your average-- we'll say an average cat weighs what like four kgs. So that's about 30 mics. So maybe a little high. So maybe you can try a little bit lower and see if that's less sedation and then more vomiting. And then I'll do the charcoal in a couple of

slides. So if I don't answer your question, feel free to throw it back in the chat.

Gastric lavage

- Requires the patient to be anesthetized with a cuffed endotracheal tube in place
- Warm water (5-10 ml/kg) administered slowly through a stomach tube
- Potential complications
- Not typically first-line



https://www.dog-health-guide.org/dog-bloat.html

The other thing that's an option is gastric lavage. We really don't do this super often. So this is really common in people, but obviously in our patients, we try to induce emesis. It requires the patient to be anesthetized with a cuffed endotracheal tube in place to prevent aspiration. The times I'll do this is when emesis is contraindicated or it was ineffective, and I know that whatever is in the stomach is really, really potentially dangerous and I want to get it out.

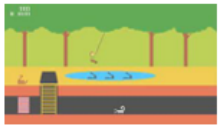
So I anesthetize them, again, have them intubated, make sure their airway's protected. And then we're basically just measuring an orogastric tube to their xiphoid, lubing it, placing it carefully into the esophagus and stomach, lavaging with warm water essentially until the water runs clear, and you can just have their head sort of hanging down off the table with the water coming back out. And then you can give charcoal down the tube as well after you lavage.

Certainly there's potential complications. So I would say the biggest one is aspiration pneumonia, but you can definitely have other things like esophageal perforations or electrolyte abnormalities. Again, it's something we don't do commonly. So I would say it's not first line. It's really in our patients the primary way of us decontaminating our patients is going to be through inducing emesis, again, just because of the need to do anesthesia and then intubate them.

Activated charcoal

vetcetera
PRESENTED BY VetPrep

- Binds toxins in GI tract
- Most benefit within 2 hours but may still be useful up to 24 hours after ingestion
- Should not be given to patients at risk for aspiration
- Give every 4-6 hours for toxins that undergo enterohepatic circulation



https://www.medi-vet.com/LLOYD-ToxiBan-Suspension-p/19627.htm

And then charcoal, so knowing when to give charcoal and knowing when not to give charcoal is going to be important. So obviously charcoal binds toxins in the GI tract. It's really, really beneficial within the first two hours, but can be useful up to 24 hours after ingestion. Shouldn't be given to patients at risk for aspiration. And then it can be given every four to six hours for toxins that undergo intrahepatic circulation. So things like NSAIDs. If we know there's going to be intrahepatic circulation, we'll go ahead and give it every four to six hours.

One of the things I really like to tell owners, just so they don't freak out when they get home is their stool is going to be black. Like we know that's a side effect of charcoal. That's something they should expect to happen. Telling an owner that will save you in your clinic time, because they're going to call back and be really, really worried because the stool is black, and they don't know why. So again typically I'll just warn the owner.

If we don't know exactly what the toxin was, I'll still go ahead and give charcoal just in case it is something that binds. And, again, time is really important. So the faster we can give charcoal the better. And people they recommend within five minutes, which is completely impractical in our patients. I think we're lucky if we see toxicities within the first couple of hours. But just thinking about again it's a stable toxicity. It should really be seen as soon as possible.

Activated charcoal

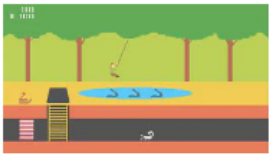
- Typical dose 1-3 g/kg
  - Only first dose with cathartic
- Non-symptomatic patients may be persuaded to ingest the charcoal mixed with food
- Symptomatic patients may require sedation, intubation and administration of charcoal through a stomach tube

Personal photo

And then typical dose. So I think the problem with dosing charcoal, I agree with Samantha in the chat, is that it comes in a variety of forms. So it comes in powder. It comes in a liquid. And then it comes in this gel form where you kind of twist up, almost like an equine med, where you twist up and then click the dose that you want. A typical dose if you're using regular activated charcoal in the bottle is about 1 to 3 grams per kg. So if you look at the bottle it'll tell you how many grams of charcoal are in that bottle.

And then you can also use charcoal with a cathartic in it to speed up GI transit and try to eliminate any exposure. Luckily dogs can be persuaded-- a lot of dogs can be persuaded to eat the charcoal if you mix it with food, but symptomatic patients if we feel like there's a benefit from giving charcoal, they may need to be sedated or anesthetized and have the charcoal given through a stomach tube. We usually only give the cathartic once, because if we keep doing that, we'll probably get electrolyte and fluid abnormality. So I usually do it once and then if I'm repeating it because it's something like an NSAID, then I'll just use regular charcoal without the sorbitol or the cathartic.

- Drugs that bind well to AC
  - Acetaminophen
  - Anticoagulant rodenticides
  - Aspirin
  - Narcotics
  - Pyrethrins
  - Digoxin
  - Strychnine
  - Organophosphate/carbamate insecticides
- Drugs that do not bind well to AC
  - Alcohol, caustic acids
  - Ethylene glycol
  - Heavy metals
  - Metaldehyde
  - Petroleum products
  - Salt
  - Xylitol



So this is just a few drugs that bind well and don't bind well. So, again, if you know what the drug is, that's always going to be super helpful for your plan. But these are some of the more common things. So things like Tylenol, anticoagulants, this whole list, they do bind well. Drugs that don't bind well, so ethylene glycol is absorbed so quickly. And then interestingly, xylitol actually does not bind to charcoal either. So those would be things where it's probably not worth giving charcoal.

IV lipid therapy (IVLE)

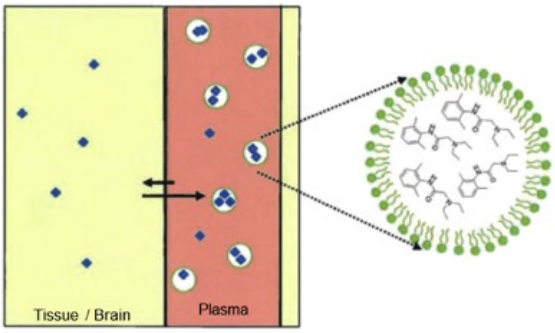
- Potential antidote for lipophilic toxins
- Potential indications:
  - Local anesthetics (lidocaine, bupivacaine)
  - Permethrin
  - Muscle relaxers (baclofen)
  - Avermectin parasiticides (ivermectin)
  - Calcium channel blockers
  - Some antidepressants
  - Marijuana

https://www.medvetforpets.com/intoxication-management-with-intravenous-lipid-emulsion-ile-therapy-for-dogs-and-cats/

And then I love IV lipids. I'm not sure if everyone has had the chance to use them, but they quickly became one of my favorite things for managing toxicities. So essentially it's a potential antidote for lipophilic toxins. There's a ton of stuff in the vet literature now. It was discovered in human medicine when they were doing experiments on rats with local anesthetics and they would basically stop their heart with an overdose and then they would resuscitate them with just lipids. So it's pretty terrible medicine, but also a pretty cool way to figure out that we could use lipids for toxicities.

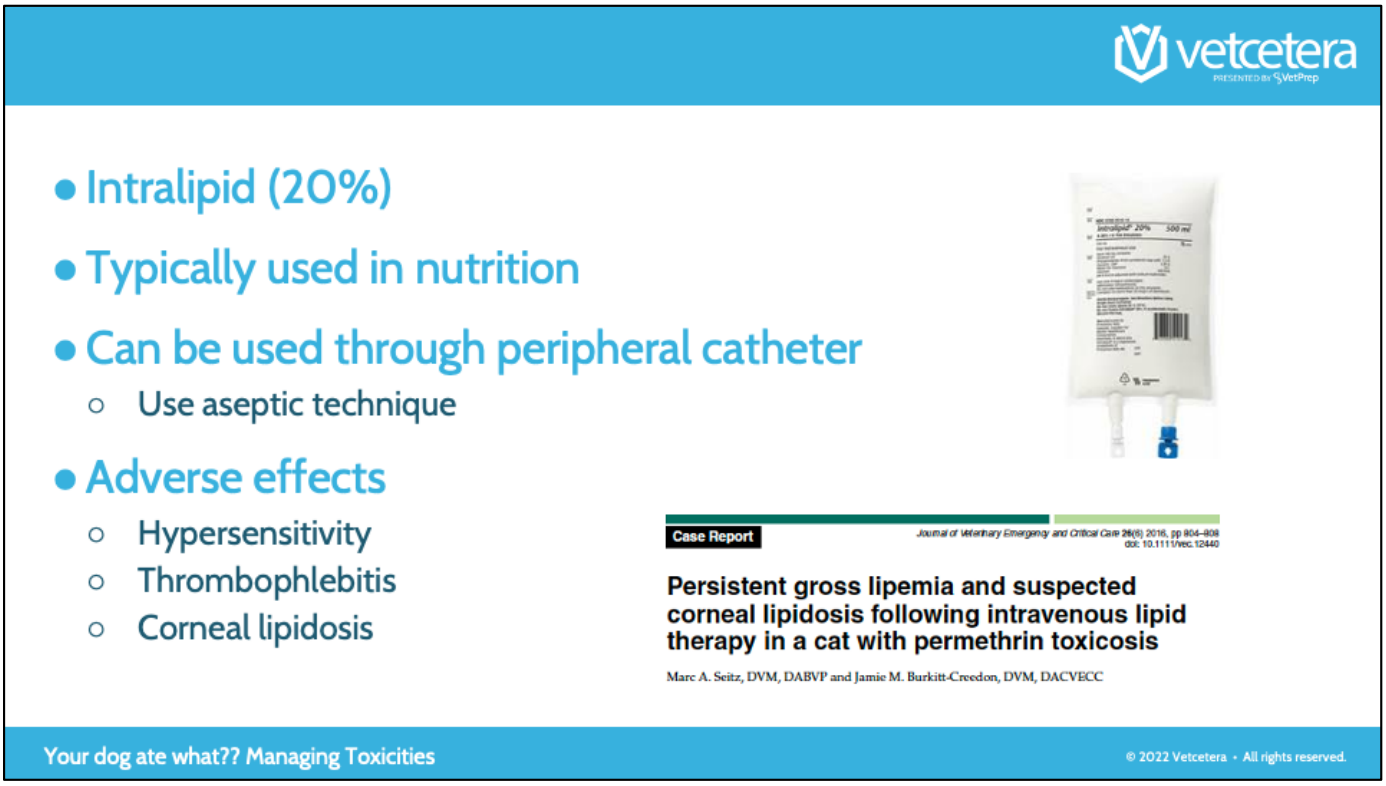
So it has to be a lipophilic toxin. These on the page are probably the most common things we see. So, again, those Permethrin cats we can use lipids and get them out of the hospital faster. Baclofen toxicity, which is a muscle relaxer, historically those cases had to be ventilated because they would basically stop breathing. And now we can give lipids and try to speed up the time in hospital. Ivermectin, calcium channel blockers, some antidepressants, and then marijuana you can actually use lipids for as well.

- MOA not firmly established
  - "lipid sink" theory
  - Improved cardiac performance



Joris Henricus Robben, Marieke Annet Dijkman. Lipid Therapy for Intoxications,Veterinary Clinics of North America: Small Animal Practice. Volume 47, Issue 2, 2017, Pages 435-450.

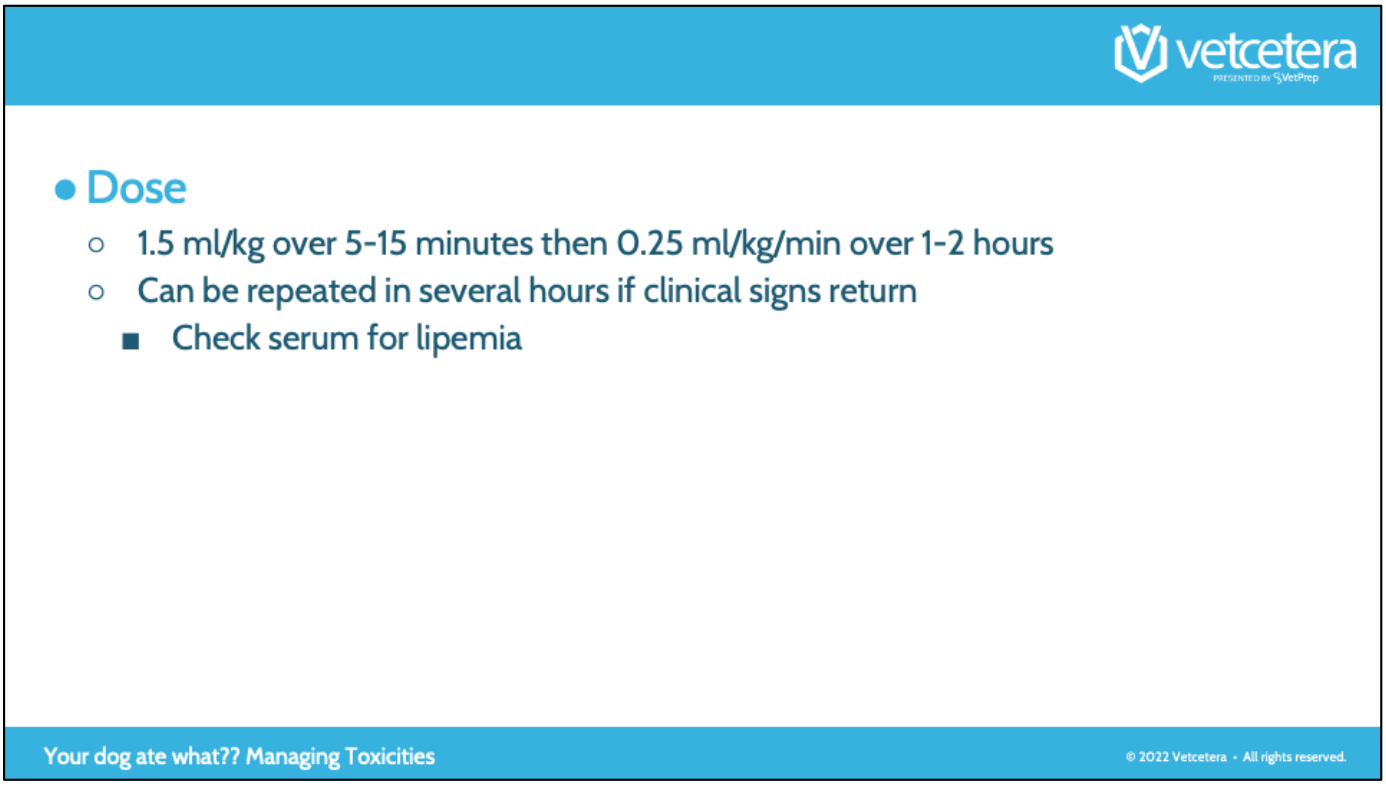
The mechanism of action is not totally understood. The thought is it creates like another separate plasma component, where the lipid is and then the toxin moves into it, and then it gets excreted separately. And then sometimes it can actually improve cardiac performance as well. So it's one of those things, it seems to be helpful. We don't completely know why, but we still use it.



The nice thing is it's just intro lipids so it's the same lipids that you would use. If you were making a nutrition solution. So if you don't have it in your hospital, the human hospitals around you should definitely have it. It has a very long shelf life if it's not open. So sometimes it's worth just having a couple of bags in the hospital. It can be used through a regular peripheral catheter, but it is a nice growth medium for bacteria, so ideally the catheter should be placed aseptically.

And then there are some adverse effects. So it can cause hypersensitivity, thrombophlebitis, and then corneal lipidosis. So this was a cat that basically got Permethrin and was treated with IV lipids, and then had corneal lipidosis. So it's just something that I usually warn owners about. I have never seen it personally, but I feel like the one time I don't warn an owner, I will probably see it.

Shelf life of the lipid. So I want to say-- like don't quote me-- I want to say if it's unopened, it's two years. So it's a long shelf life because it doesn't have to be refrigerated or anything. Once it's open you have to use it and throw it away because essentially it's going to cause there could be rapid bacterial growth because it's fat. So if I open it and I don't use it within that first 12 hours when the patient's in the hospital, then we'll just throw it away.



And then the dose we steal-- we'll say steal/borrow a lot from human medicine. So the dose that's out there is kind of extrapolated from what they do in people. So it's an initial bolus over about 5 or 15 minutes, and then a CRI over a couple hours. And it can be repeated in several hours if the clinical signs return. So typically what I'll do-- so say it's like a Permethrin cat. We give it lipids it looks a lot better a couple of hours later, the cat starts twitching again. We'll just quickly pull a PCV or a hematocrit tube, spin it down, and make sure the serum is not lipemic. If the serum's still lipemic, then the lipids should be doing their job. So if the serum is cleared up, then we would give another dose and see if that helps.

And I think in vet med, we often give lipids when we don't know what the toxin is because it's pretty benign and it's not super expensive. So for me, if I have a young dog, it comes in with abnormal acute signs, it's like an indoor or outdoor dog. The owner is not really sure. I'll usually go ahead and offer them a dose of lipids, again, just because it's not cost limiting, and it is something that can help very, very quickly. If the dog doesn't improve with lipids, it's probably not lipophilic.

And if you're not sure if something is lipophilic, you can just Google the drug, and then what you're looking for is the log P of a substance. And there's like a million websites. So if you just Google like Permethrin log P, it'll tell you like this is a lipophilic drug or this is a lipophobic drug. And if it's lipophobic, there's not going to be a whole lot of use from giving it.

The other thing to think about is if I give lipids and this dog is on a drug, like a maintenance drug of phenobarbital because it has seizures, what effect will that have on the phenobarb? So thinking about that if it's something where, again they're on a drug, or you're giving them another lipophilic drug you're basically removing the effects of that drug as well.

Specific antidotes

Toxin	Antidote
Acetaminophen	N-acetyl cysteine
Serotonin syndrome	Cyproheptadine
Ethylene glycol	Fomepazole (4-MP), ethanol
Insulin	Glucagon
Opioids	Naloxone
Vitamin D, cholecalciferol	Pamidronate
Anticoagulant rodenticides	Vitamin K
Organophosphate	Pralidoxime (2-PAM)

And then these are just some specific antidotes for different toxins that we see. Again, we don't have a ton of antidotes in vet med. I would say probably the most common thing we give an antidote for is anticoagulant rodenticides. Vitamin K is easy to access. It's cheap. We've had a lot of trouble getting 4MP lately. So we've done some ethanol. And then these are some other common things that, we'll go ahead and see.

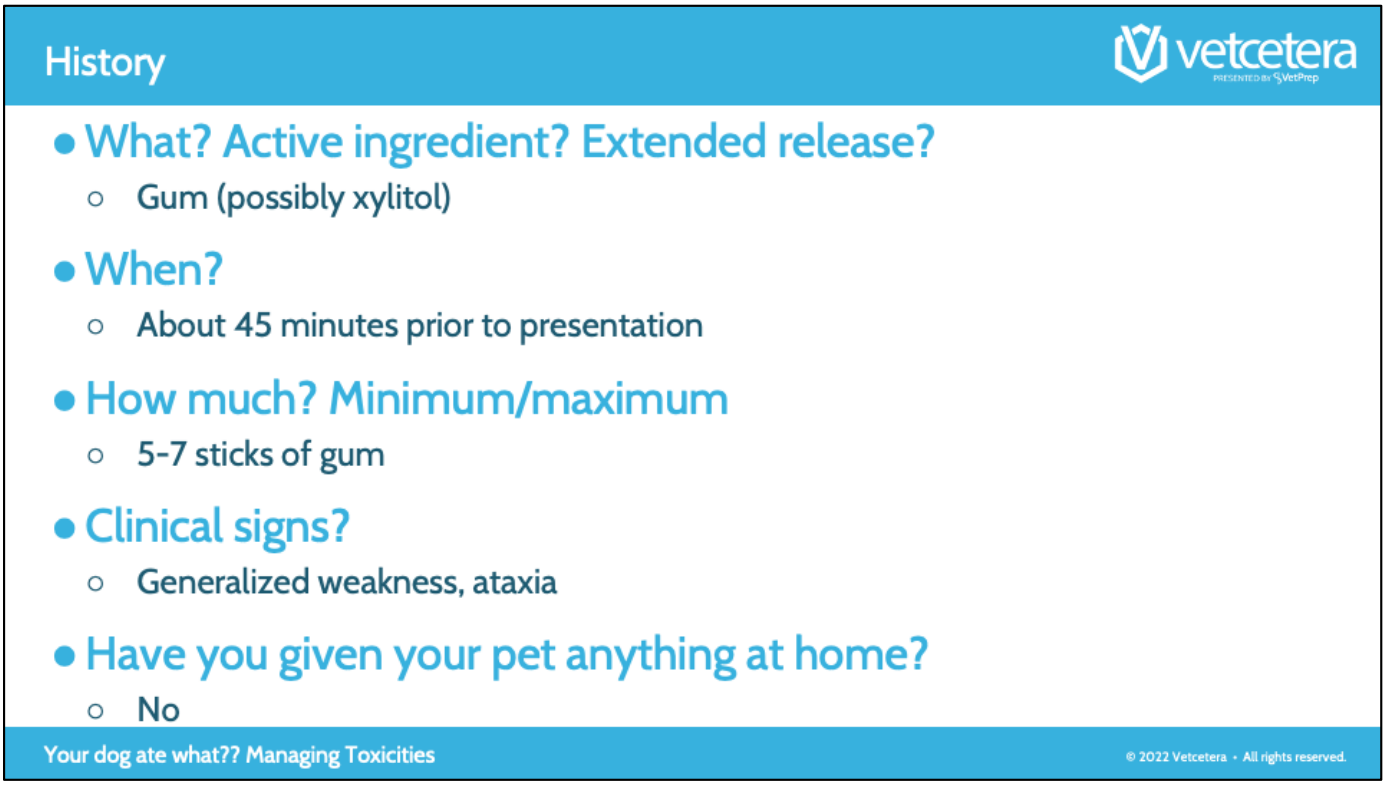
Case #1

- Maggie, 2-year-old FS Labrador
- Presents for generalized weakness, ataxia
- Rummaged through owner's purse and ate gum

https://www.twenty20.com/photos/0c23e679-1ddf-491d-aab5-0f8b2535f85b

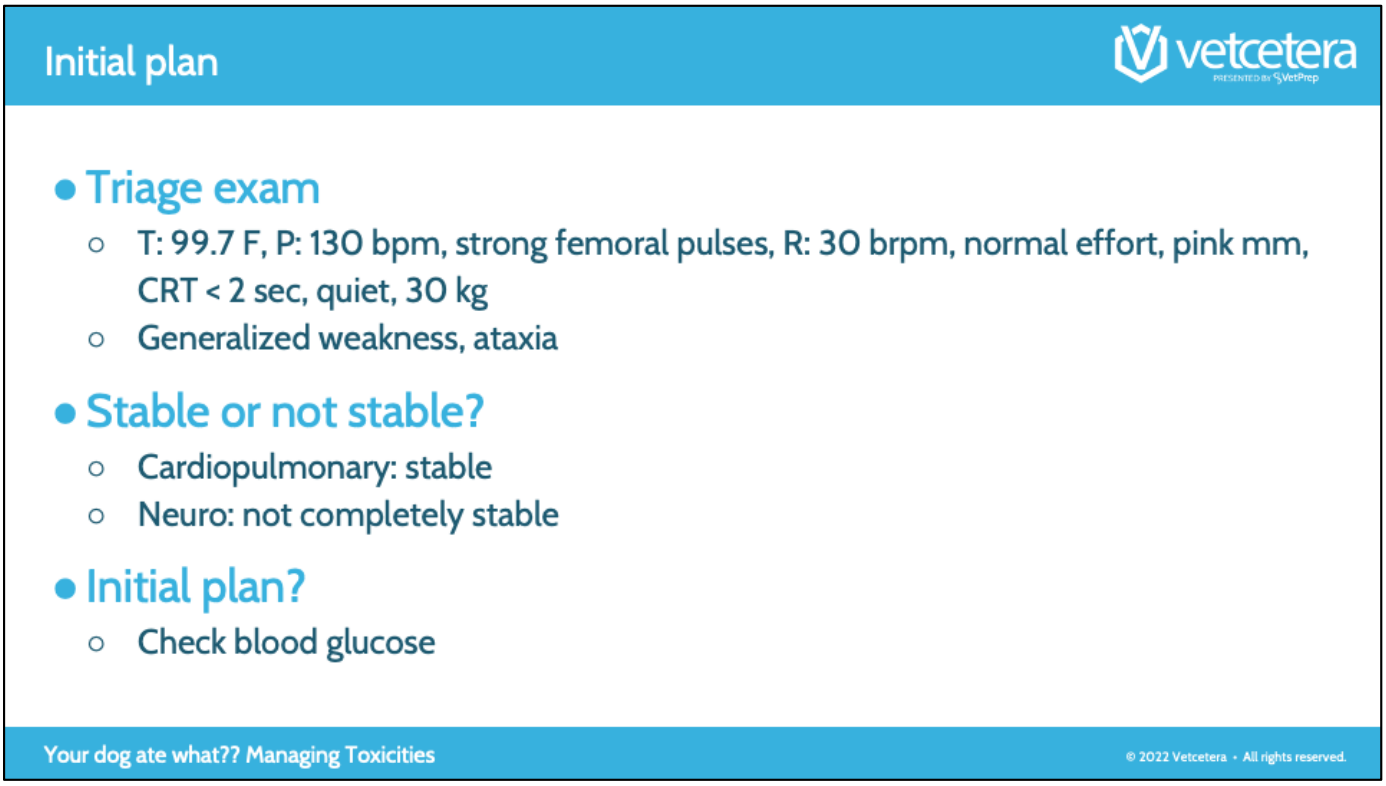
https://www.walmart.com/ip/Orbit-Speamint-Sugar-Free-Chewing-Gum-14ct/20918394

All right, let's see. So we have some cases. So I went really fast through that first part because I wanted to make sure we had enough time on the cases. So I would love for people-- it looks like people are chatty, which I appreciate. So we'll talk through these as a group. The first case is Maggie. She's a two-year-old female spayed lab. She presents for generalized weakness and ataxia. The history of the owner gives you is that the dog was rummaging through the owner's purse and ate a pack of gum. So packaging, gum, wrappers the nine whole yards.



So really when we're taking a history, we want to ask these questions because we really want to know what did they eat, when, how much, and then have they given anything at home. So if we ask this owner, she says the dog ate gum. They have no idea if it has xylitol in it. So we'll probably have to Google that. Gum doesn't really come in extended release. They actually saw the dog in the purse, so they can give you a pretty good time frame which is always nice. So about 45 minutes prior to coming in.

They didn't know exactly how many sticks of gum were left in the pack. They're estimating somewhere between 5 and 7. The dog's clinical signs are generalized weakness ataxia, and then they did not give anything at home. So those are the things I usually want to ask. And at some point it's nice to say, does the dog have any other medical history on any of their meds, like find out that information. But this is really what I want when I'm dealing with the toxin initially.



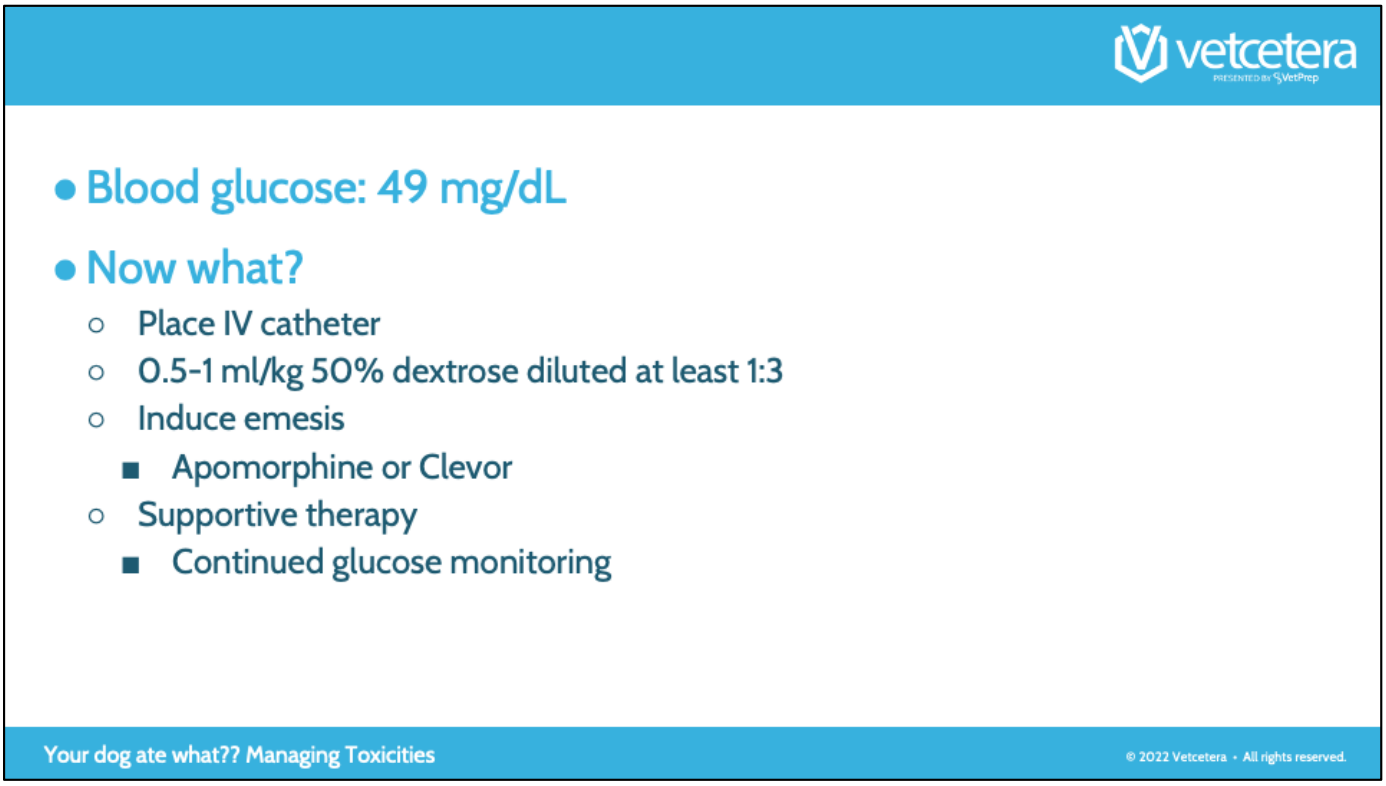
So we do our triage exam. So our dog, whose name I forgot already, Maggie. Her temperature is 99.7, heart rate's 130. She has strong pulses. Respiratory rate's 30 with normal effort. CRT is less than two seconds. She's quiet, and she weighs 30 kilograms. Really the only thing we're finding is she's weak, and she's ataxic.

So the first question for case is coming in that you should think about is, especially with the way ER. There's ER services shutting down. There's places where the weights are six or eight hours. We really want to figure out, does this case, need to be seen immediately, or can it wait and go to maybe an urgent care or back to its regular vet. So what do you guys think for this case is this a stable dog or an unstable dog?

Yeah, so stable. Yeah, and whoever-- yeah, Amy, that wrote vitals are stable, but I don't like the ataxia. I love it. So when we're evaluating these cases on triage, we're really looking at heart, lungs, and neuro. For me this dog is cardiovascular stable, respiratory system totally stable, but the dog is weak and ataxic. So I'm starting to go through those differentials in my head. Even if I didn't have the xylitol, this is a two-year-old dog. Is this dog-- has it gotten into something. Kind of running through my rule out list. So I would say stable cardiovasculary and respiratory, but not as stable neuro.

And then what would your initial plan be? So this dog hits the door. The technician gets your history. This dog ate xylitol containing gum 45 minutes ago. The owner is on board with whatever you recommend, which is always nice. Love it, yeah. So I would definitely induce vomiting. I mean this dog's a little bit weak and ataxic, but I feel like she's probably

OK to have vomiting induced. And then checking a glucose for sure. So we know that xylitol, this dog is probably ataxic and weak from being hypoglycemic, so maybe I check a glucose, get her on supplementation, induce vomiting, all in the same amount of time, so we have a normal glucose before we make her vomit.



All right, so blood glucose was 49, and then I think everyone was on board with making her vomit. So again, she's ataxic. We have the history of xylitol. I think it's great if we can start correcting that. So give her a little bit of bolus of a dextrose solution get the glucose up a little normal, maybe see if some of those clinical signs go away, and she's more neurologically appropriate. Induced emesis, so again for dogs I like apoe or Clevor. And then supportive therapy, so continued glucose monitoring.

Xylitol

vetcetera
PRESENTED BY VetPrep

- 5-carbon sugar-alcohol, low calorie sweetener
- Candy, gum, peanut butter, low-carb foods

Your dog ate what?? Managing Toxicities

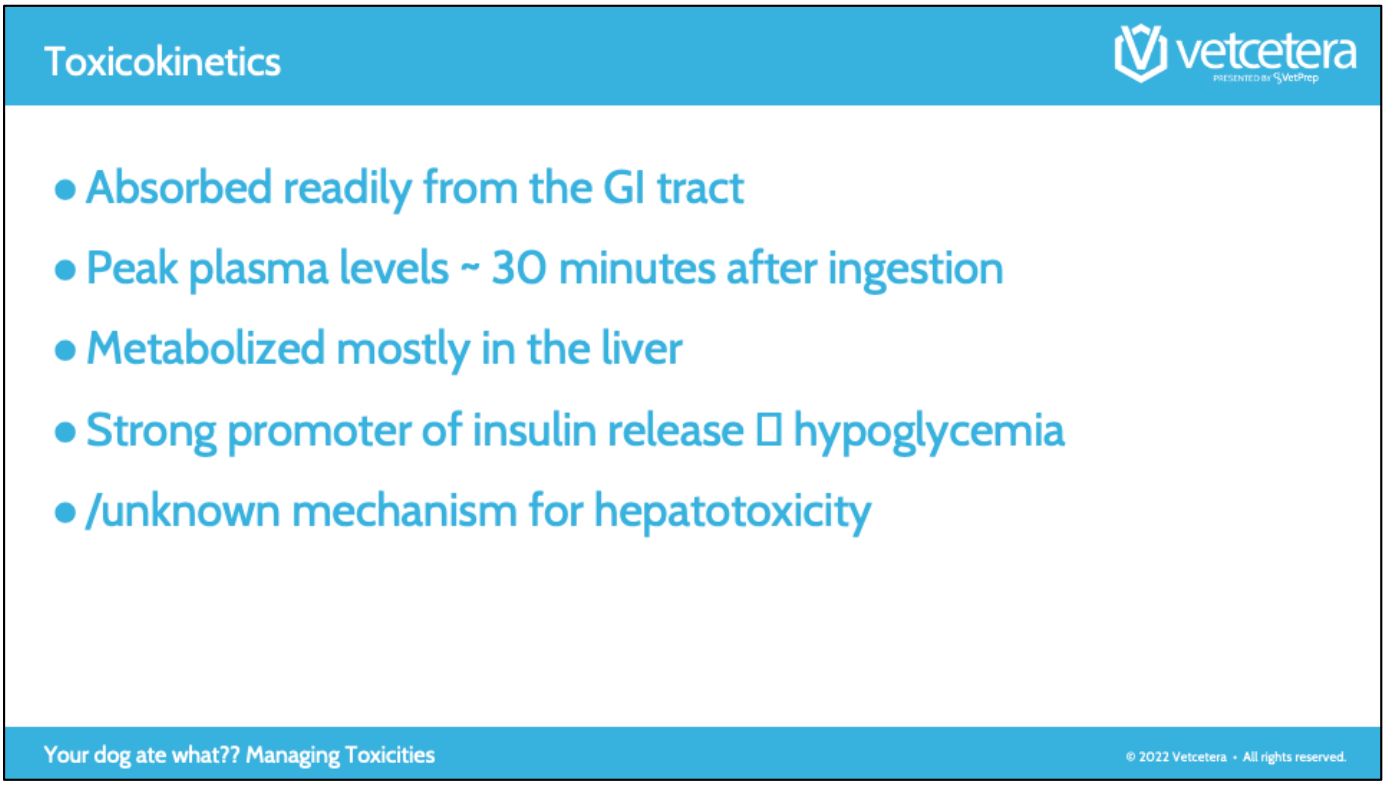
So xylitol is in everything apparently. I keep seeing like little warnings pop up all over the internet of different things that gets added to now and different names that it's called. So it's a sugar substitute so it's in a lot of low calorie, low carb things. I think probably the most common thing we see is gum, but I know it's in peanut butters and different-- this is a picture of different things it can be in. My favorite is the Flintstones vitamins, personally. But again, if the owner isn't sure. If the dog didn't eat the packaging, it's really nice to be able to say, here's the jar of peanut butter that the dog was eating, and then, oh look, xylitol is the second ingredient after peanuts.

Toxic dose

- Margin of safety is quite high in species other than dogs
- Dogs: 0.1 mg/kg associated with hypoglycemia
  - 1-2 pieces of gum in a 10 kg dog
- Hepatotoxicity-idiosyncratic? Higher doses (>0.5 mg/kg)
- Difficult to calculate exposure dose

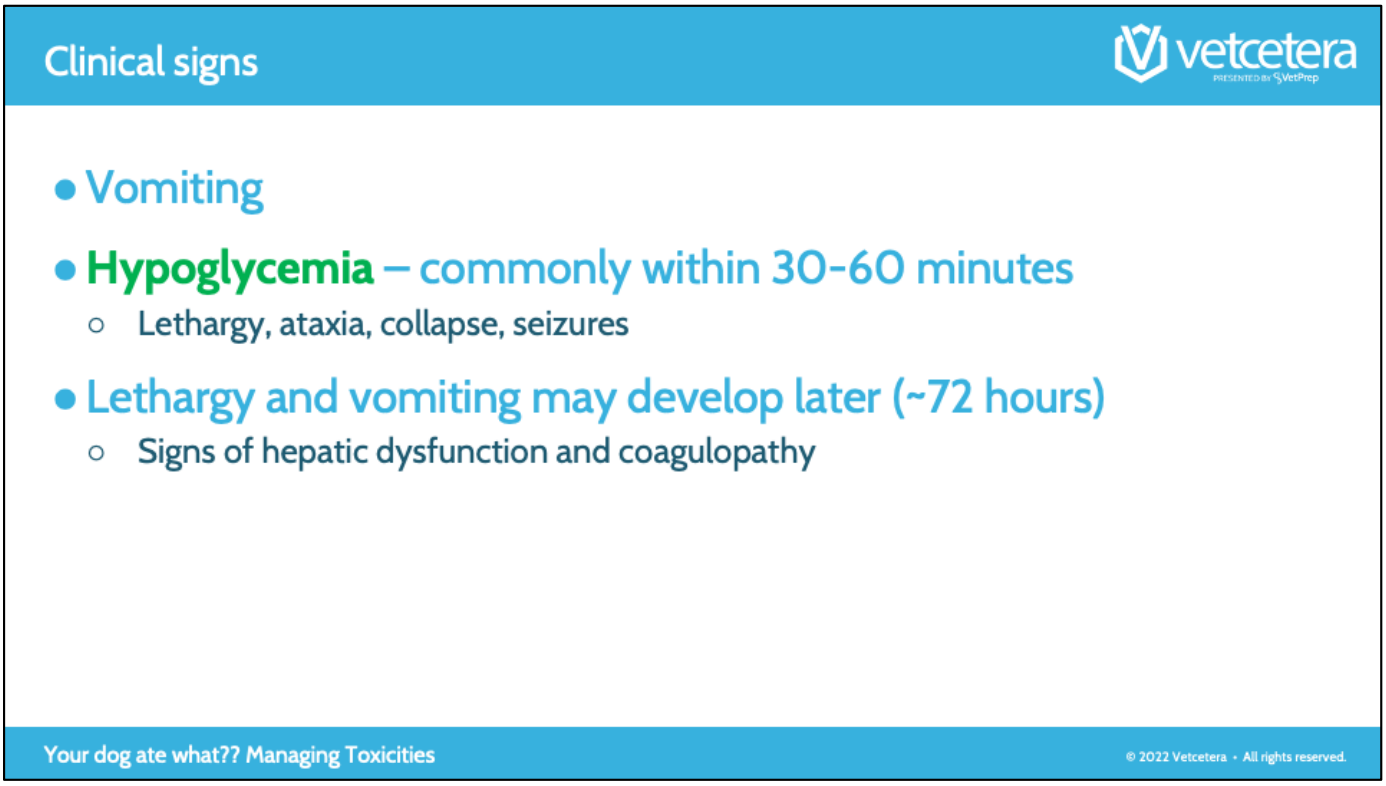
Obviously, when we xylitol, we don't get hypoglycemic, so the margin of safety in other species is really, really high. Dogs it's fairly low. So 0.1 mgs per kg, they can get hypoglycemic, which is only a couple of pieces of gum in a fairly medium sized dog. It's helpful if you again have the label and you can see where in the list the xylitol. Is if it's the 10th ingredient versus the second ingredient, there's probably going to be a big difference in the toxicity.

And it makes it hard to calculate the exposure dose. So really is this dog clinical? Is it hypoglycemic? And then treating it appropriately. Some dogs also experience hepatotoxicity. It's probably a combination of an idiosyncratic reaction, as well as higher doses. So more than about one half a mic per kg.



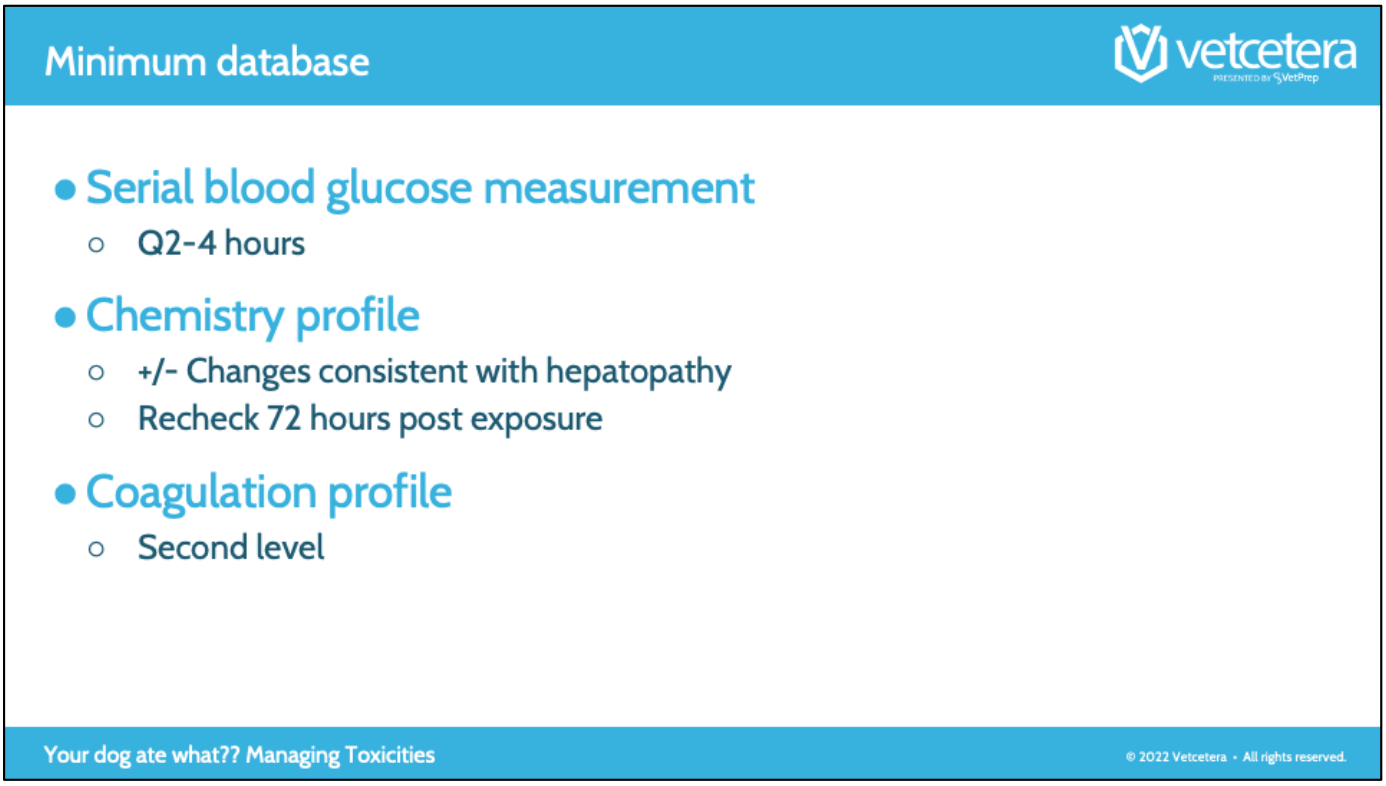
It's absorbed really fast. So this is one where we want to induce vomiting as quickly as we can and peak plasma levels happen about 30 minutes after ingestion. So again, are we seeing all of our cases within 30 minutes? Probably not. So if it's a little bit longer than that, it's reasonable to make them vomit as long as you feel OK with the neurologic status, maybe correct the hypoglycemia first. It's metabolized mostly in the liver. And then in dogs, it's a strong premolar of insulin release. So they have this huge insulin release and then they get hypoglycemic. Again, that doesn't happen in people, and we're not really sure what the mechanism for hepatotoxicity is.

And it's not-- I think someone said peanut-- it's not all peanut butter. So just checking the brand. Because I mean we feed our dogs peanut butter all the time because we're terrible owners, and we just use like Skippy or Jiff or whatever like, regular peanut butters, and they usually don't have it. But really just checking the label before you use it for treats or pills or whatever.



Clinical signs, some dogs actually vomit after they eat it, which is always really nice because they decontaminate themselves, but hypoglycemia is really going to be the most common thing. And it's going to happen pretty fast, so within about 30 to 60 minutes. Most dogs that I've seen with xylitol are lethargic and ataxic. I haven't seen a ton that come in seizuring, but certainly that could be a presentation as well.

For me, for any seizure in case, regardless of signalman, I always check a glucose because that's going to be a much different workup than if it's a primary neuro problem. And it's a really, really easy thing to rule out or rule in. So always just checking a glucose. And then they can develop hepatic dysfunction up to three days later. And the blood glucose can take a few days to resolve as well.



So for a minimum database I usually like to do blood glucose every few hours. I usually like to get it doesn't have to be a full chemistry, but like a baseline liver panel or whatever, an ALT, ALP, just if you want to pick a couple of things. And then rechecking it at about 72 hours later. And if it's still good to go, then they're fine. If they're having increases in their liver values, than obviously that's going to change prognosis. If they develop fulminant liver failure, then obviously the prognosis gets much, much worse, and we'll probably do other things like a coag panel and much more aggressive care.

Question, how long before we can say they're in the clear if they're not hypoglycemic after an hour? I'd probably keep them in the hospital for a couple more hours, so maybe four hours before I'd feel really good about saying like everything's fine. You can just take them home. And for whatever reason, when I worked at Auburn, there was a technician whose dog ate xylitol containing gum constantly. Like always found it in her car, and never ever got hypoglycemic. So there must be some sort of idiosyncratic component that not every dog gets clinical. So if they go about four hours, then I'd feel fine that they could not be admitted and go home.

Treatment

- Emesis if no contraindication
- IV fluid therapy + dextrose supplementation
- High-carbohydrate diet
- Supportive therapy for higher doses
  - i.e. SAMe
- Supportive therapy for liver failure

https://www.mcguffmedical.com/dextrose-50-25-gramsvial-sdv-50ml-vial

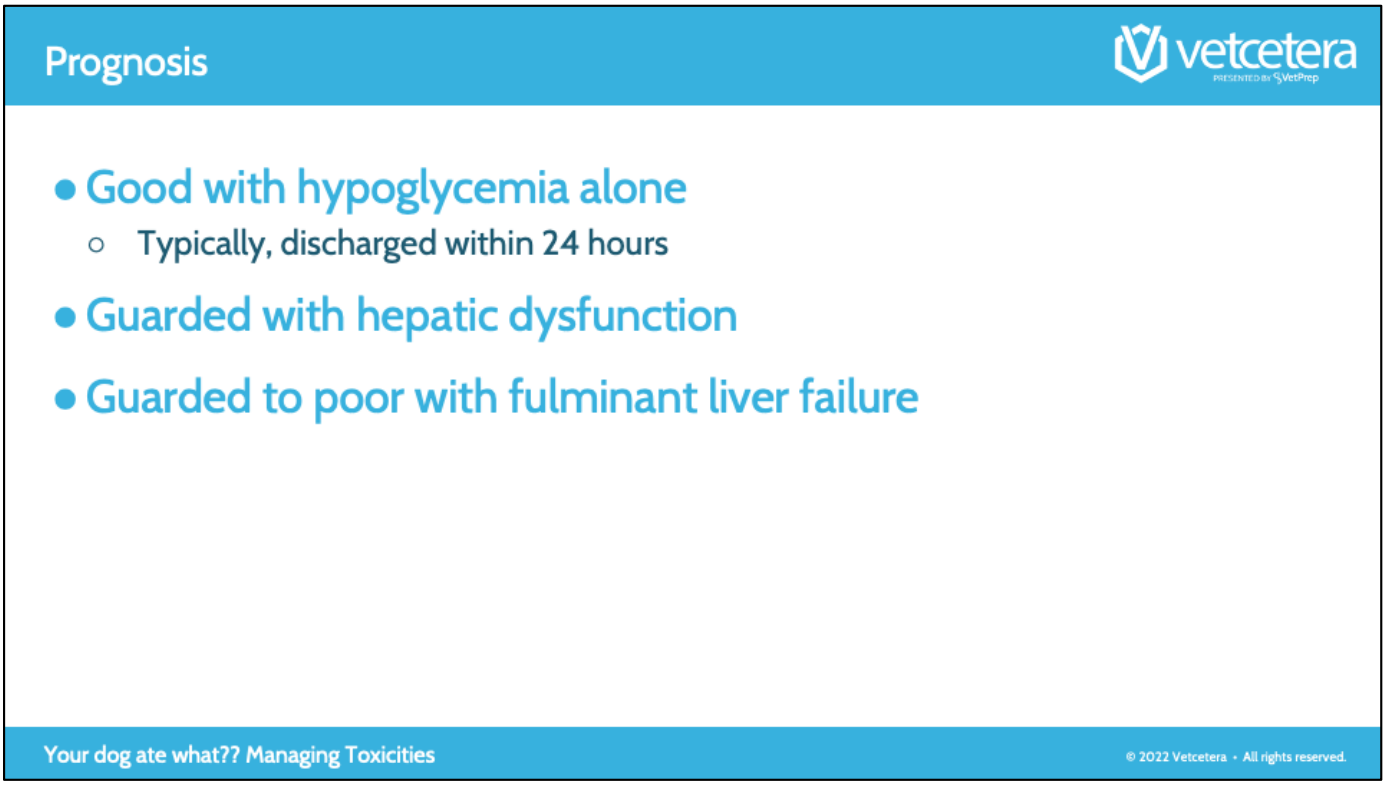
And then for treatment again, emesis if there is no contraindication. The main thing is really going to be IV fluids with dextrose. So if they're hypoglycemic, I usually tell the owners they're probably going to be in the hospital about 48 hours for dextrose and monitoring. And then we'll try supplementing with a high carb, frequently fed diet as well, especially if money is an issue. Trying to get them eating a lot frequently and see if the owner can maybe do that at home.

If we know they ingested a higher dose, so maybe we know that they got into half a mic per kg or higher, sometimes I don't know that there's a lot of evidence behind this, but I'll start something like SAMe denamarin early, and just hope that there's no liver injury. And then if they go into fulminant liver failure, unfortunately, the prognosis gets much worse, and it's just going to be really supportive therapy.

So I always do denimarin, but mucomyst was used after talking to poison control once, and lately it's been hard to get from human pharmacy. Are there any similar things I could use? I mean, I don't know if are you talking about injectable mucomyst or oral, because I think any quote unquote liver protectant that has an antioxidant properties, so like SAMe denamrin is probably going to be the same.

I don't know that there's any evidence that one is better. I usually use injectable mucomyst, like inositol cysteine in my liver failure cases, but not necessarily for those. Do I wonder if they had a reason for picking that instead of something else. But yeah I mean, if I can't find mucomyst I've called like the human hospital before but I haven't heard that it's

hard to get again my other choices would be like SAMe denamarin just other liver protectant drugs.



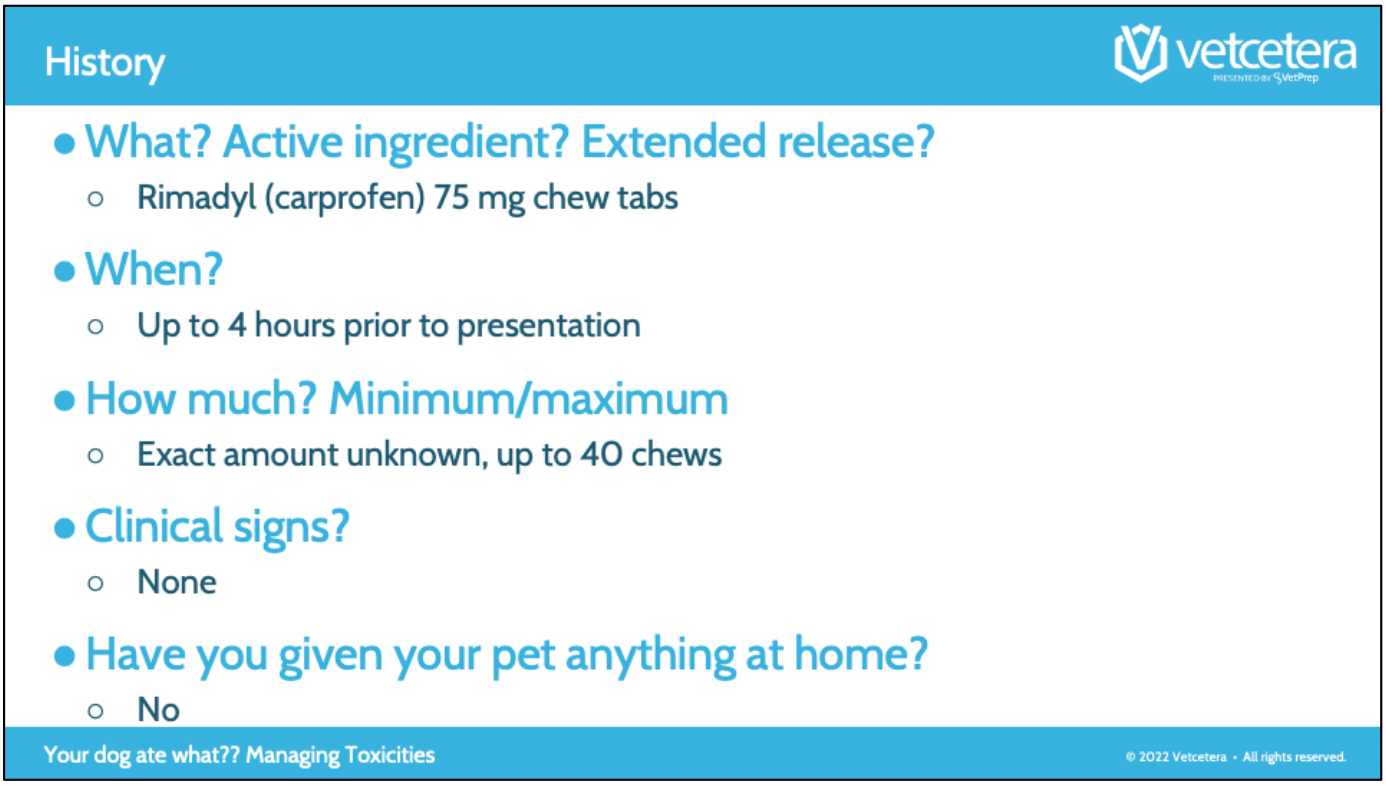
And then prognosis. So if they're just hypoglycemic, they usually do just fine. They're typically discharged within a day or two. If they develop some elevated liver enzymes, but they're not super clinical those are cases that usually-- I warn the owners because we don't know for sure that they're not going to develop liver failure, but if they kind of stabilize liver values, we'll just recheck them in a few days after being on denmarin. If they go into fulminant liver failure, obviously the prognosis is not great , and it's going to change the financial commitment from the owner as well.

Any diet recommendations for the owner that is at home and can't get to the ER? Induce vomiting with hydrogen peroxide. I mean, it's really just going to be feeding them super frequently something that's high carb. So I would say feed every two hours with a high carb diet. If they have something canned, like a dog food at home. They can just do that every few hours, but it's just going to be depending how clinical the dog is. If the dog is like seizuring, that's probably not going to work. If the dog is ataxic, they could try like karo syrup or something else. But if it's really significant clinical signs, they're probably going to have to come in.

Case #2

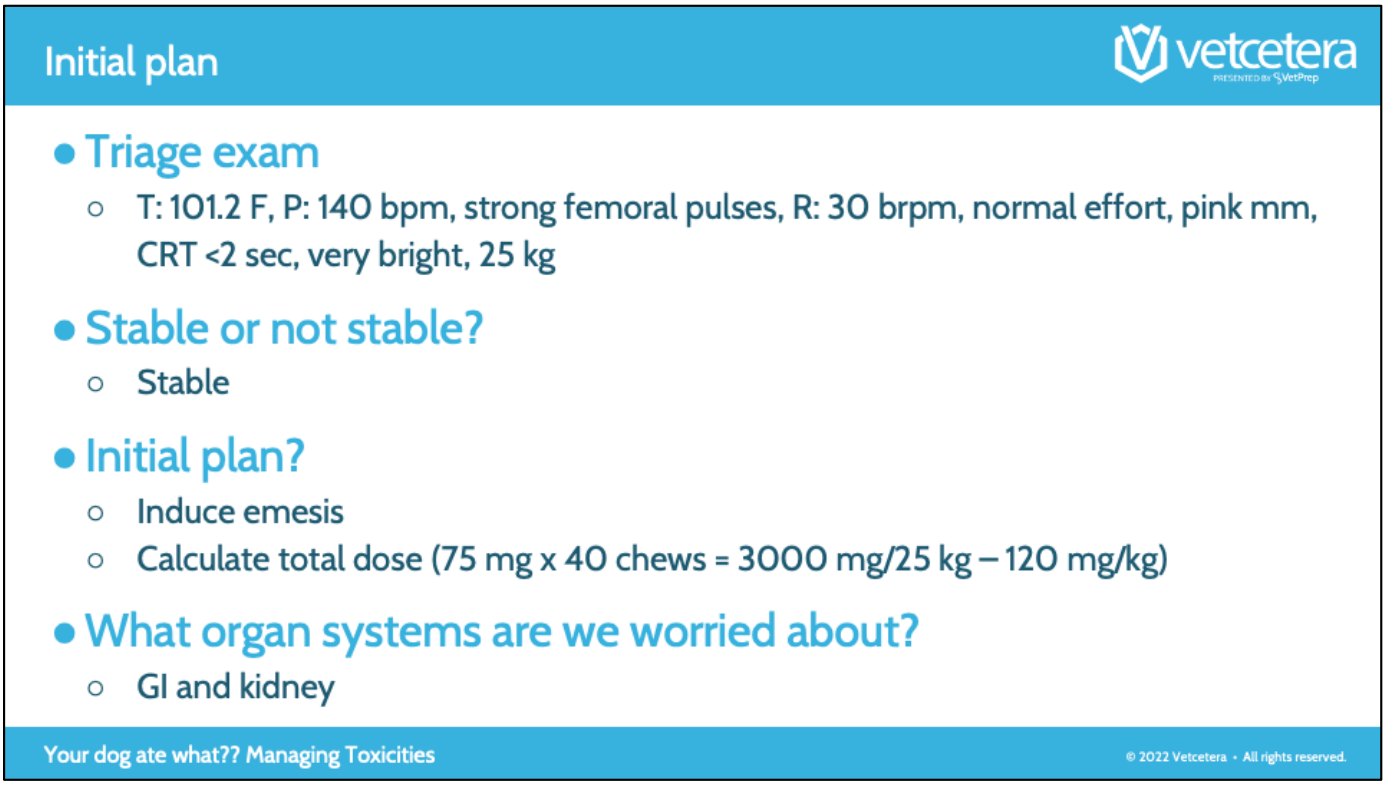
- Buster 4-year-old MN Mixed breed dog
- Presenting for ingestion of Rimadyl chew tabs

All right, the next case is Buster. He's a four-year-old, male neutered mixed breed dog who presents for ingestion of rimadyl, excuse me, chew tablets. Essentially, the owner came home. The bottle was chewed up because they taste delicious. Most of the tablets were gone as well.



So when we ask our owners, our standard kind of set of questions for toxicities, we ask, again, what is it? So it's rimadyl they were 75 milligrams two tablets. The owner was out of the house for a few hours, so it could have been anywhere up to about four hours. They don't know exactly how much, but they're thinking probably somewhere up to about 40 chews.

So we're asking for the amount, we really want to go as kind of conservative as possible for clinical signs. So if the owner says there's somewhere between 30 or 40, I'm going to assume the dog ate 40 when I calculate out toxic doses and how I'm treating this dog just to err on the side of caution. The dog's not having any clinical signs, and they did not do anything at home.



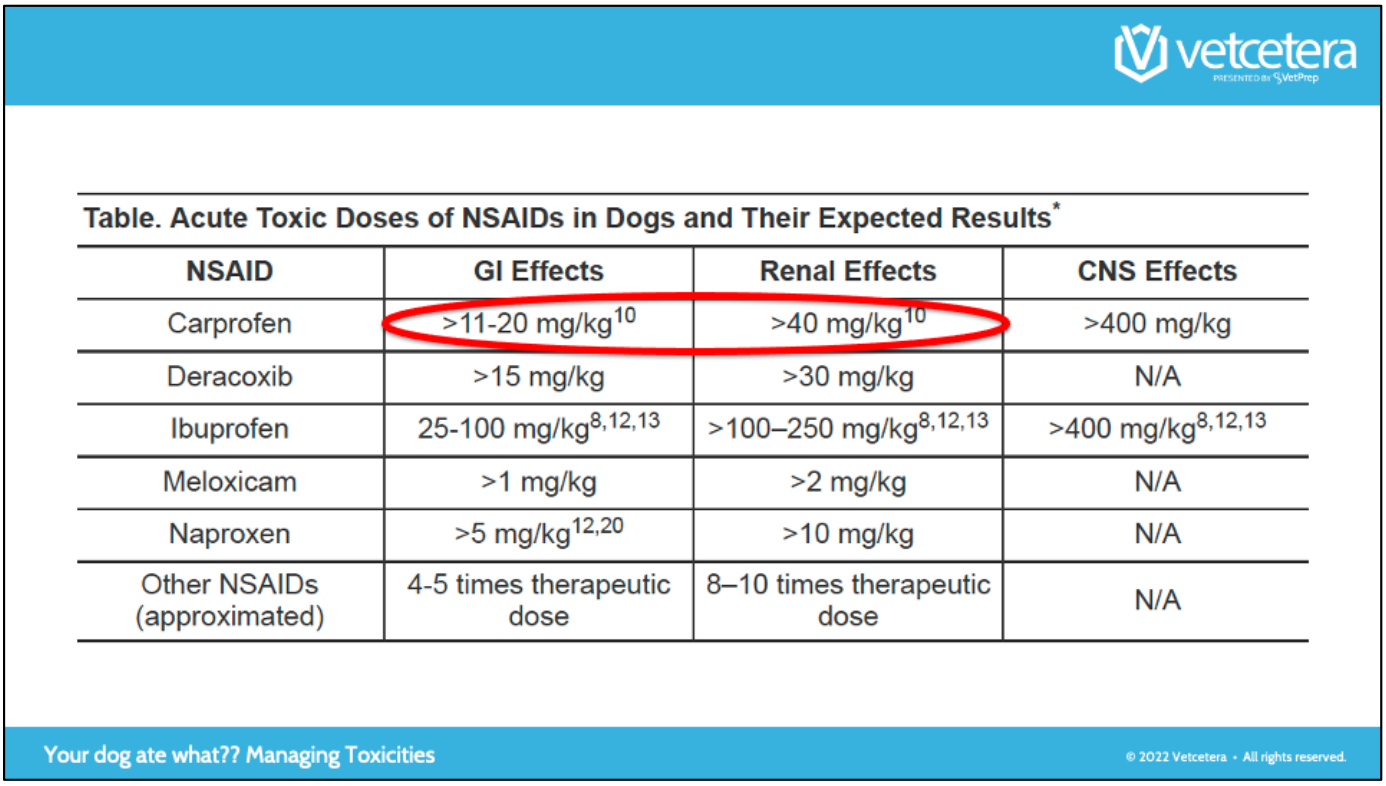
So initial triage exam the dog's temp is 101.2. Pulse is 140. Strong pulses, respiratory rate's 30 with normal effort. The dog is very, very bright and weighs about 25 kg. So stable or not stable? Yeah, so really stable. So this dog clearly has no clinical signs. It's feeling really good. It's probably super happy with itself. It just ate 40 tabs of something delicious and tasty. So this dog, same thing. Comes in, owner is-- they want your recommendations. They'll do anything. So what would your initial plan for this little friend be?

Yeah, so this is a dog-- again, this dog is really, really stable, but we know that time is really important. So I would induce vomiting, and then I would like charcoal in this dog would be amazing. So these dogs, again, any onset is going to have enterohepatic recirculation, so we're probably going to want to get charcoal into this dog as soon as possible. And then I saw a few people write baseline blood work. So definitely figuring out what is the mic per kg dose that this dog ate, and what organ systems do I have to be worried about. So we'll talk a little bit about that when we figure out the dose.

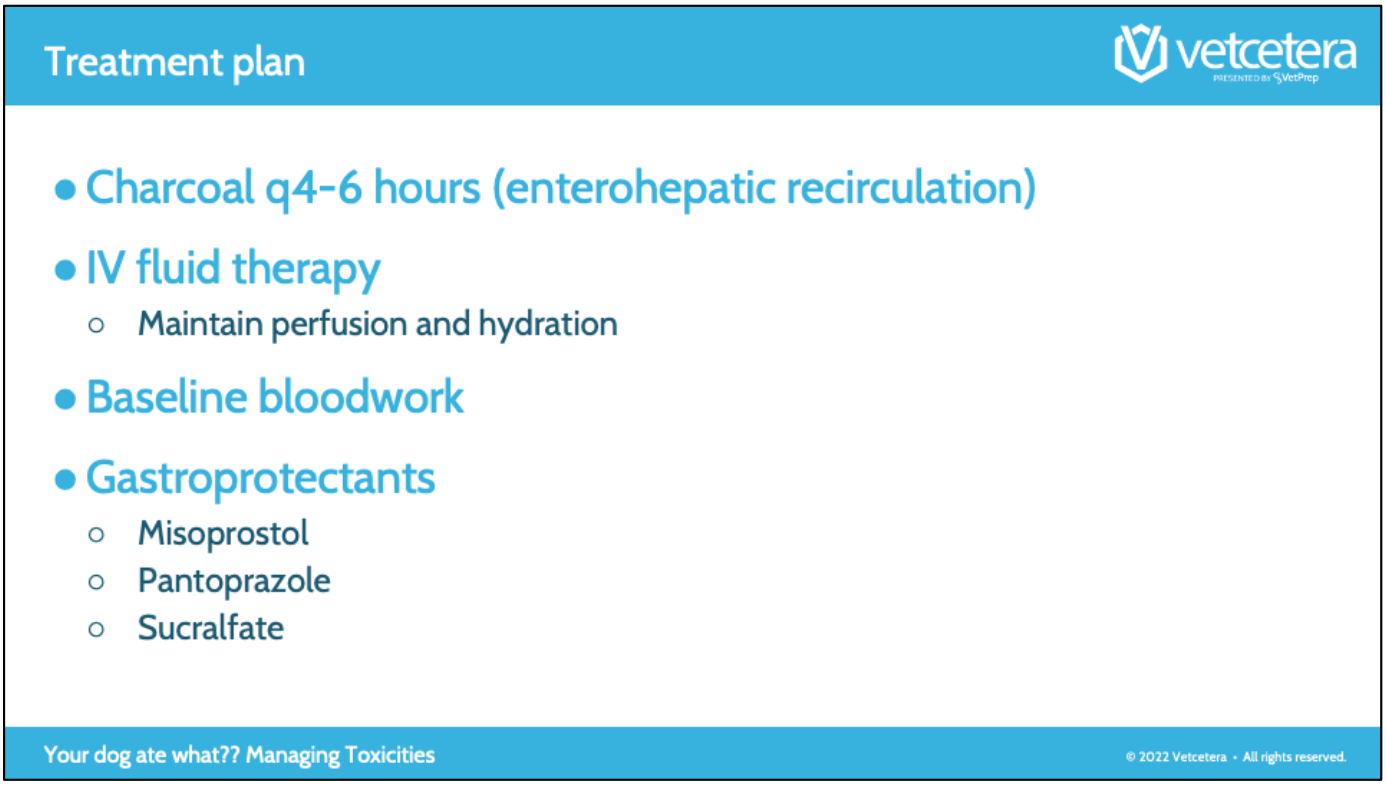
So if we calculate it out, so assuming the dog ate about 40 chews, that ends up being somewhere about 120 mgs per kgs. So what's the most common organ system that we worry about with NSAID toxicity? So a few people are saying GI. There's some kidney and liver. So GI is actually the most common, followed by a kidney. Liver is actually super, super uncommon. It's an idiosyncratic reaction. So it's really, really low on my concern list.

So for me, I'm concerned more about GI. So is this dog going to have horrible ulcers? Is it going to perforate? And then is the dog going to go into acute kidney failure. I also worry at

really high doses about neurologic signs and coagulation problems, but that's going to be like super, super high doses. Most of the time we're worried more about GI and kidney.



There's these lovely charts. This is taken from Venn, but you can find it in any textbook, where you can look at different drugs, and it'll tell you what dose you need to be worried about what organ system. So I believe our friend ate 120 mgs per kg. So we're saying probably GI and probably renal. And then probably not CNS because that's 400 mgs per kg. So for me I'd be really concerned about GI effects and renal effects for this dog. So when I'm talking to the owner about my plan, those are the things I want to be treating aggressively. That's what I want to be monitoring because that's my expected organ systems that are going to be in trouble.



And then for these guys, charcoal every four to six hours. Not fun. Certainly if the dog is we'll say smart enough to eat it mixed in food, that's always lovely. But otherwise, has to be given by somebody, and it's quite messy. But really this is a case where I feel like it's very, very important. We want to maintain perfusion and hydration. So we don't want to give the kidneys another reason to be upset. So we don't want this dog to become dehydrated or hypotensive. Getting some baseline blood work just so we maybe, this dog has chronic kidney failure, and it's going to be a lot worse if it's already azotemic. But getting at least a baseline renal panel.

And then gastro protectant. So this dog is a huge risk for developing significant ulcers and potentially even perforating. So I would start things like misoprostol, pantoprazole, or sucrofee.

NSAID intoxication

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- Popular drugs in human and veterinary medicine
  - Species differences
  - **Gastrointestinal toxicity** is the most common

https://www.aspca.org/blog/matts-blog-be-prepared-deal-pet-poisons

Your dog ate what?? Managing Toxicities

These are super popular. So this is from the ASPCA website. So over-the-counter meds are really common, including NSAIDs, including things like ibuprofen and human NSAIDs, and then veterinary NSAIDs are a little bit lower on the list. Obviously very popular. We take a lot of Advil and NSAIDs I'm sure. And there are species differences, but GI toxicity in dogs is going to be the most common.

So let's see so would you induce vomiting with peroxide if the toxic dose is at a GI dose or treat with GI protectant? So this would be a great case to really think about risk versus benefit. So for me, like if this owner lives in the middle of nowhere. They can't get to a vet clinic for 10 hours. I'm probably going to have them do peroxide, but I'm going to be really specific about the amount that they're giving. And then I'm going to start driving, so we can follow up with bloodwork and other supportive care.

At this dose this dog really needs to see a vet. This probably wouldn't be something I would feel comfortable treating just at home. If they live close, though, so if they're within a couple of hours of a clinic, I would say drive to the clinic get something injectable. Because we really don't want to cause more GI ulcerations, and then if the NSAIDs cause problems on top of that, we could probably end up with a pretty significant either ulcer or even perforation. That's a great question.

- Mechanism of action
  - Direct inhibition of cyclooxygenase (COX)

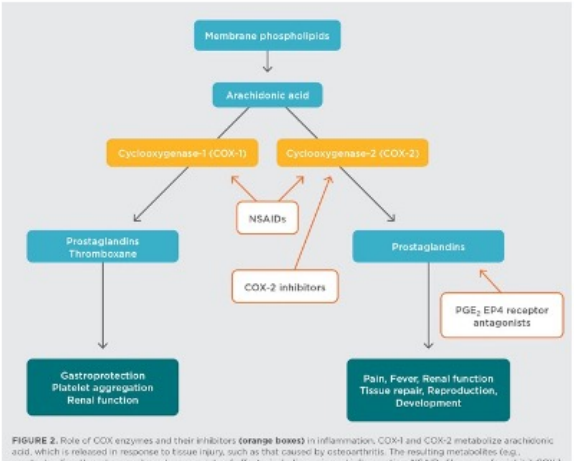
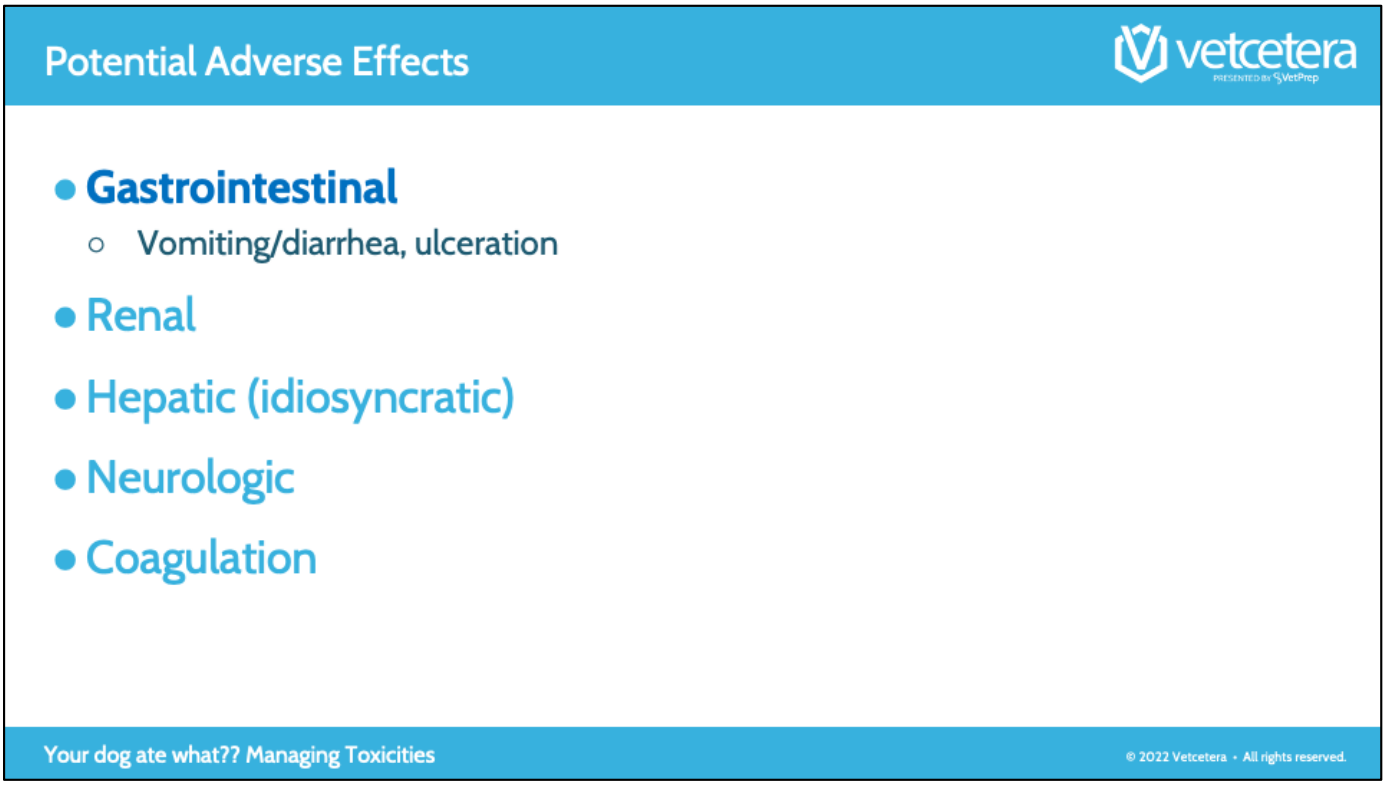


FIGURE 2. Role of COX enzymes and their inhibitors **(orange boxes)** in inflammation. COX-1 and COX-2 metabolize arachidonic acid, which is released in response to tissue injury, such as that caused by osteoarthritis. The resulting metabolites (eg., prostaglandins, thromboxanes) produce a variety of effects, including pain and inflammation. NSAIDs like carprofen inhibit COX-1 and COX-2, thereby providing an analgesic effect; other anti-inflammatory agents inhibit COX-2 only or bind to prostaglandin (PGE_2 EP4) receptors. Other beneficial actions resulting from prostaglandins, including tissue repair, gastroprotection, and healthy renal function, are also inhibited, leading to potential adverse effects such as renal impairment and GI ulceration. This diagram does not show the complete arachidonic acid pathway.

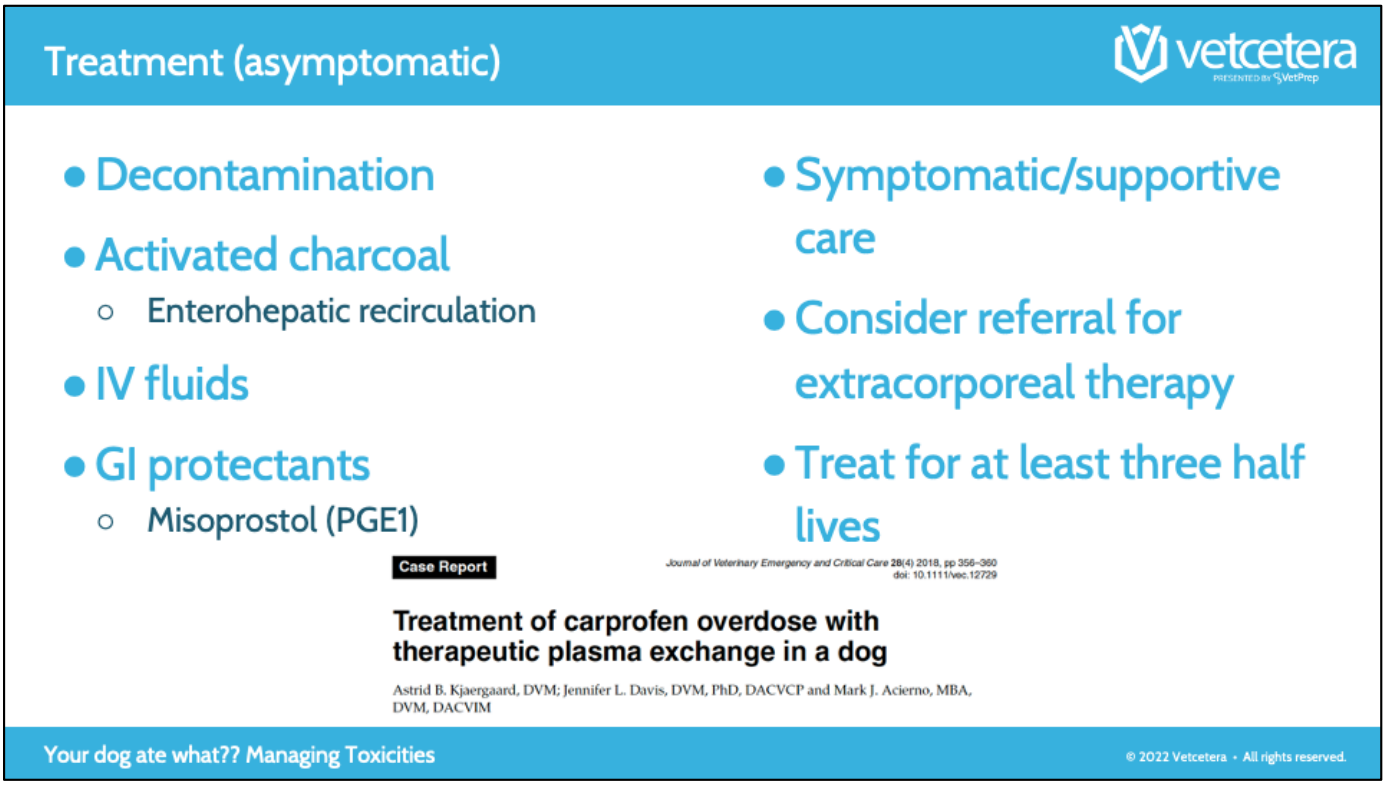
Adapted from: DiPiro JT, Talbert RL, Yee GC, et al. Pharmacotherapy: A Pathophysiologic Approach, 10th ed [online]. McGraw-Hill; 2017. Available at: accesspharmacy.com. Accessed February 2020.

https://todaysveterinarypractice.com/pharmacology/carprofen-for-dogs-osteoarthritis/

And then NSAIDs, they're working by inhibiting COX-1 and COX-2. Some are more specific for COX-2. But when we inhibit that COX-1 then we get our primary adverse effects like GI ulcerations, kidney injury, et cetera. Some preferentially preferentially, excuse me, inhibit COX-2. And if you know what drug they got into, obviously, that's going to be helpful as well. A lot of our drugs that are going to hit both at some degree.



And then like I said, the most common thing we're going to see is GI. So vomiting, diarrhea, melena, ulcerations, potentially things that come out of emesis. And then at that higher dose that we saw, we'll see things like acute kidney injury, neurologic changes, and coagulation changes as well. The hepatic is not dose dependent. It's an idiosyncratic reaction. So some dogs it won't matter how much they eat, their liver will be fine. And some dogs can get a regular dose of an NSAID that's totally appropriate for their body weight, and still have an idiosyncratic reaction and develop liver failure. So we can't really predict those dogs.



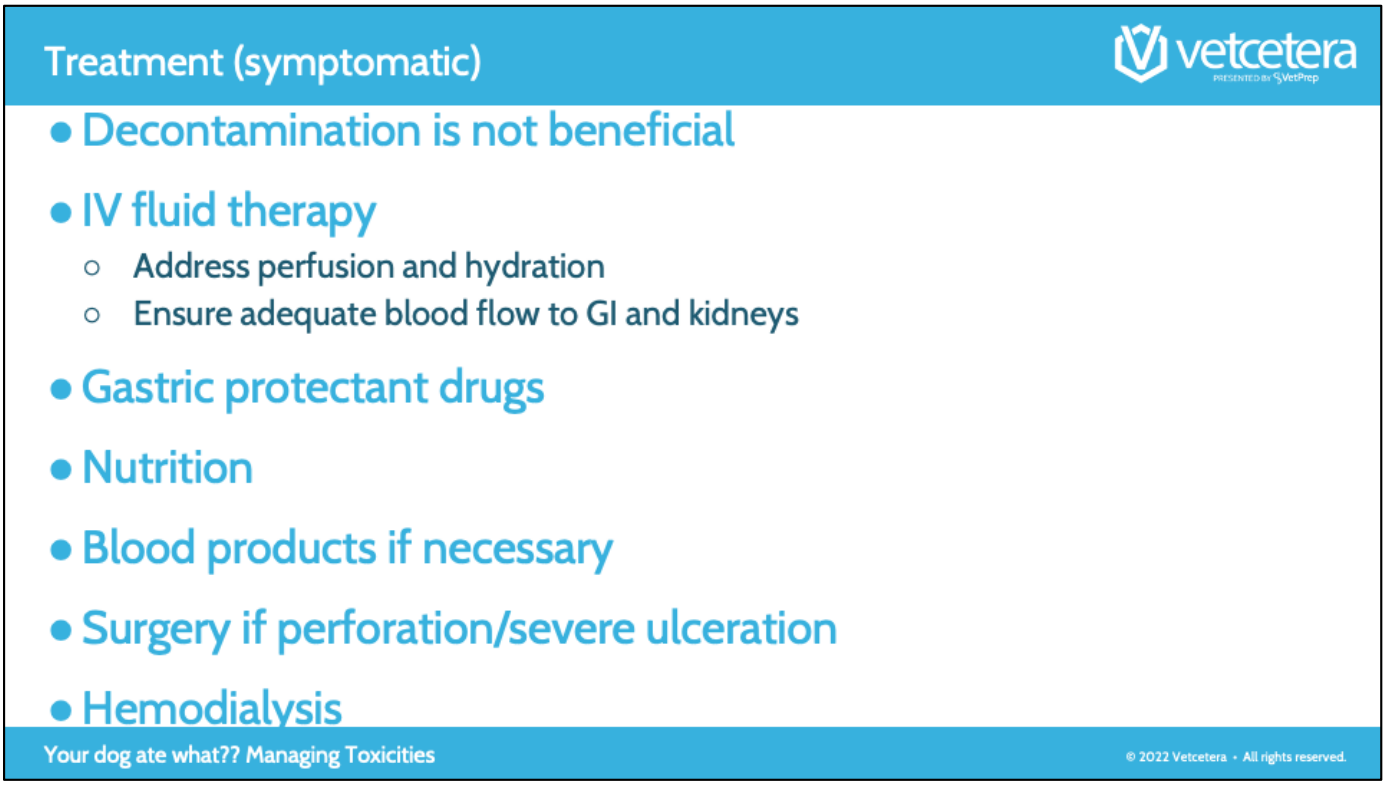
And then in asymptomatic cases, so like our friend Maggie. She comes in she just ate this insane dose. We want to decontaminate her. So again we want to make her vomit. We want to get charcoal into her. We want to repeat the charcoal every four to six hours. Fluids. So this would be a case that I would strongly recommend they hospitalize this dog because we really want to maintain perfusion and hydration to the kidneys and the GI and not have another problem. GI protectant so something like misoprostol to supplement prostaglandins.

Other general supportive and symptomatic care. There are options for dialysis type therapies you can actually remove and seds with plasma exchange. It's potentially not as expensive as you think. So if this dog stays in the hospital for just, say, three days getting fluids, charcoal, supportive care, blood work monitoring, it's probably going to be relatively expensive. A lot of these cases can just have one or two plasma exchange treatments, and the price may end up being equivocal or similar, at least. So if you're near this is something that's probably going to be bigger specialty hospitals or universities. It's probably worth looking into if the owner's interested.

And then it should be treated for at least 3 half lives. So I have no idea what the half life of carprofen is. That's what Google is for, but I would definitely want to know, so I could tell the owner again you know how long they need to be in the hospital.

And then a question about how long after the emetic is it safe to start charcoal? So typically what I do is I use emesis, I give them a dose of serenity because they probably

feel really nauseous and gross. And then right after that, I'll start the charcoal. So once the vomiting is under control. We don't want to give the charcoal and then have them vomit that immediately. So once you feel like they're not nauseous.



And then if there's symptomatic, so say this dog came in and it's already having melena, and it has ulcerations. Making this dog vomit is not going to be beneficial. At this point we really just need to treat the treatable things. So, again, IV fluids to address any perfusion or hydration abnormalities, really making sure that the GI and the kidneys are really, really well perfused. So that is another issue that we have to deal with.

And then just treating supportively so gastro protectant drugs, nutrition. I've had dogs with NSAID toxicities have such significant ulcers that they actually need blood transfusions. They can certainly perf, especially, like a high GI perf stomach or duodenum. And then if they develop acute kidney injury, this is a case where potentially dialysis would be warranted, especially if they stop making urine. Obviously that comes with significant costs. So really try to catch them early before they're symptomatic is going to be the best treatment and outcome.

Prognosis

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- Depends on dose ingested, severity of clinical signs and time to initiate appropriate therapy

Table. Acute Toxic Doses of NSAIDs in Dogs and Their Expected Results*

NSAID	GI Effects	Renal Effects	CNS Effects
Carprofen	>11-20 mg/kg[10]	>40 mg/kg[10]	>400 mg/kg
Deracoxib	>15 mg/kg	>30 mg/kg	N/A
Ibuprofen	25-100 mg/kg[8,12,13]	>100–250 mg/kg[8,12,13]	>400 mg/kg[8,12,13]
Meloxicam	>1 mg/kg	>2 mg/kg	N/A
Naproxen	>5 mg/kg[12,20]	>10 mg/kg	N/A
Other NSAIDs (approximated)	4-5 times therapeutic dose	8–10 times therapeutic dose	N/A

Vin.com

And then prognosis really depends on the dose, and when you see these cases and when they're clinical, and how long it takes to initiate appropriate therapy. So these are definitely cases where, again I know I've said this multiple times but timing is really, really important. So owners when they come in, if the dog had a toxicity, even if there's five other things waiting that are more traditionally not stable, it would be a case I'd want to at least start the process and get the dog to vomit as quickly as possible.

Case #3

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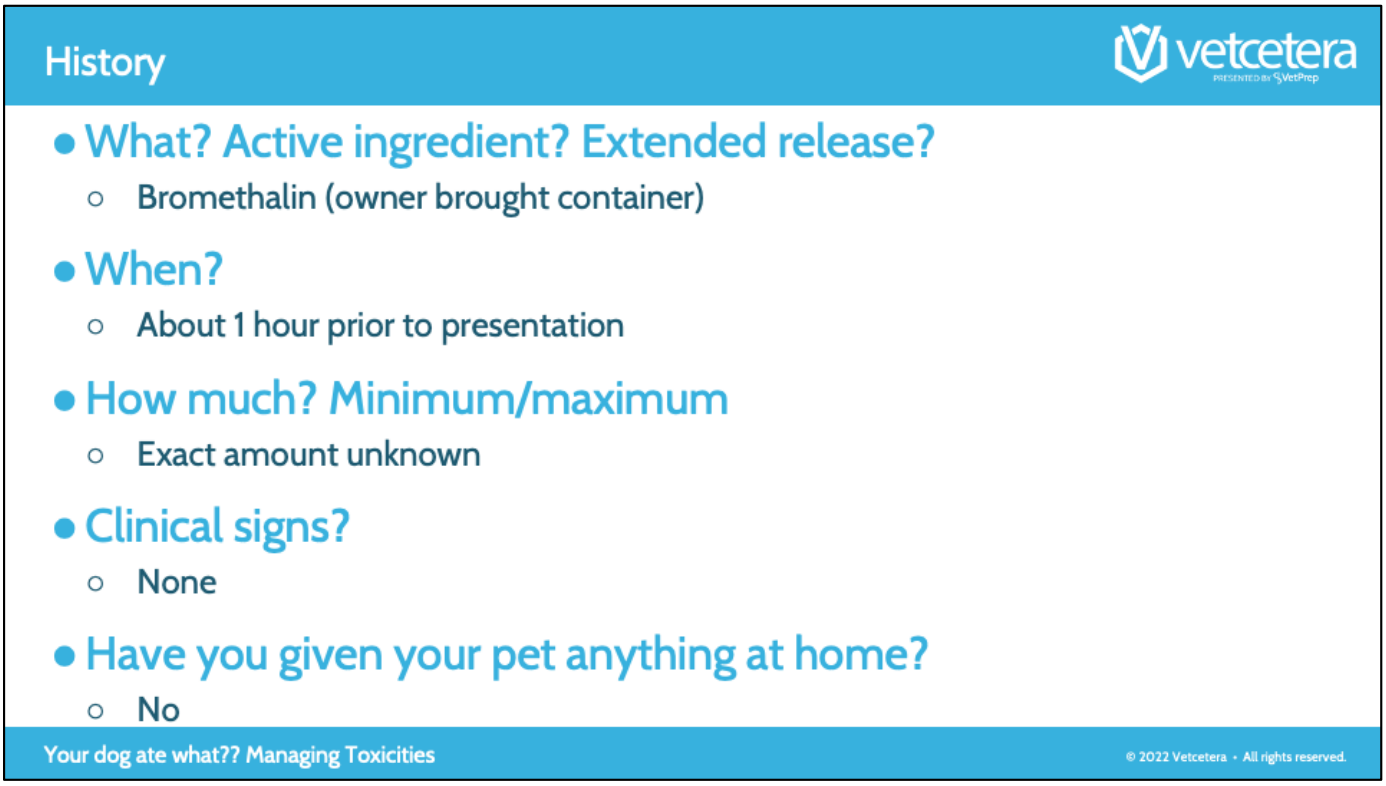
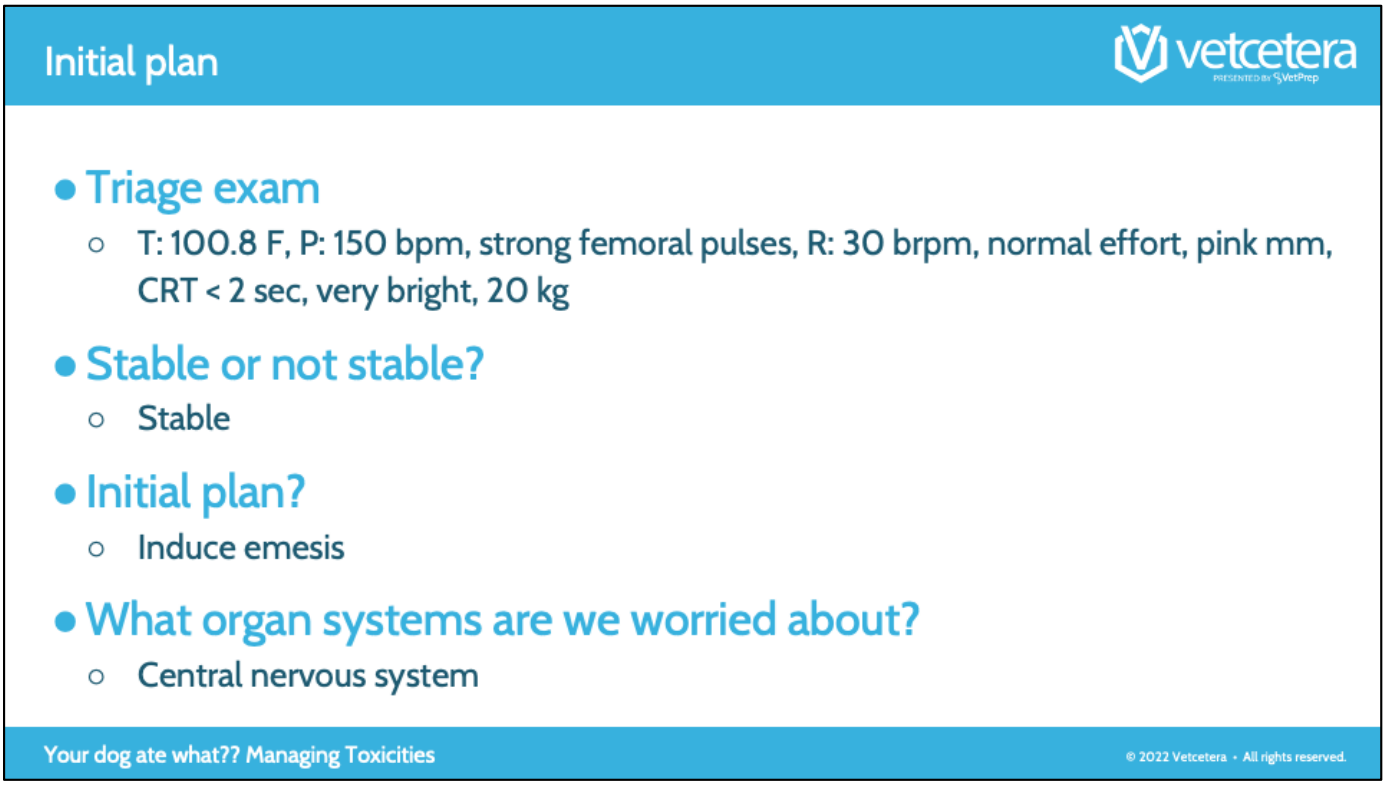
- Sammy, 1 year old MN Pitbull
- Ate an unknown amount of rodenticide (unknown primary ingredient)

https://depositphotos.com/4552326/stock-photo-beautiful-young-champagne-colored-pit.html

And then the last case that we'll go through, is Sammy a one-year-old male neutered pit bull who ate an unknown amount of a rodenticide and the owner is not sure of the primary ingredient either.



So luckily the owner was able to find the container, and it's bromethalin. The dog ate it about an hour before presenting, and then they have no idea. So basically it's a box of rodenticide. They don't know how much was in it. And they don't know exactly how much he ate. Right now, he's not having any clinical signs, and they have not given him anything at home either.



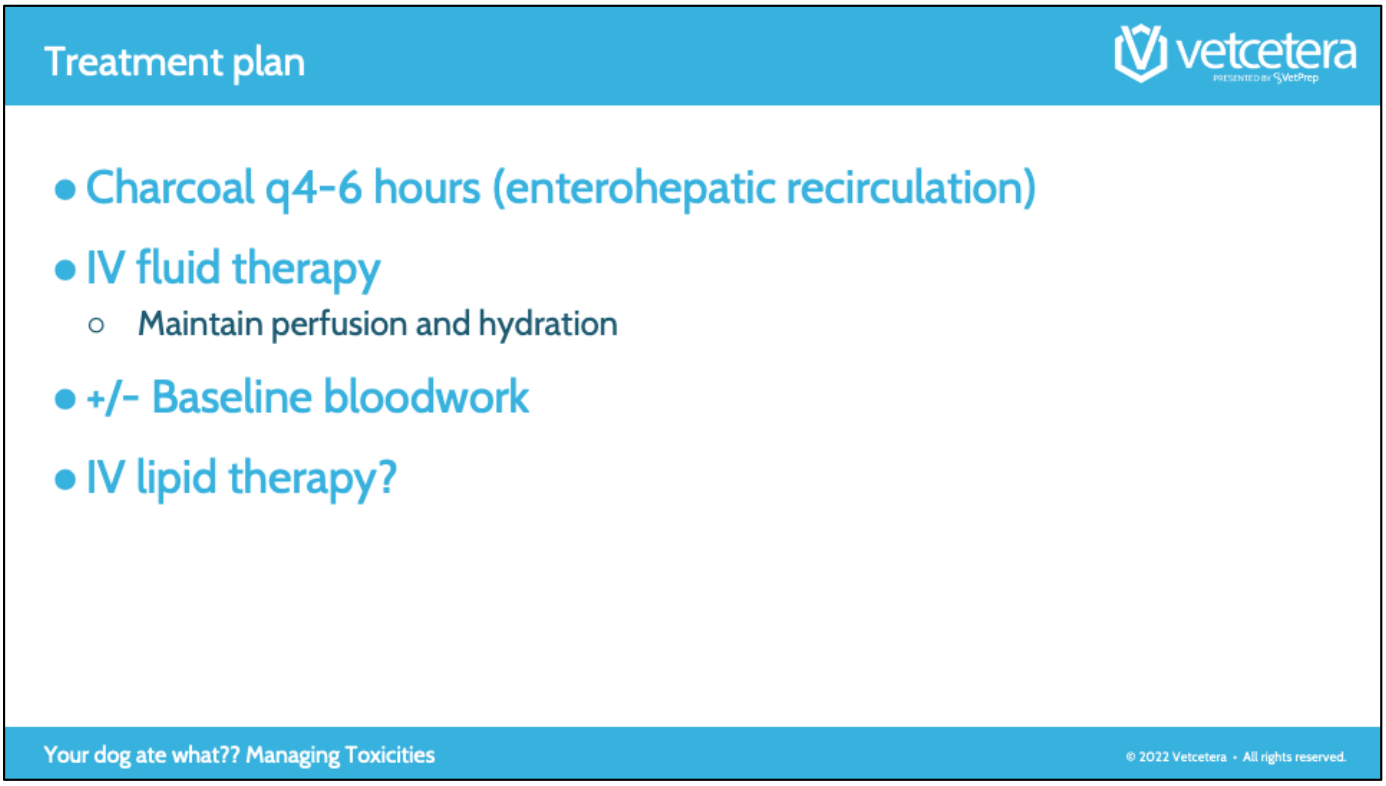
So on Sammy's triage his temp is 100.8. Pulse is 150 with strong pulses. Respiratory rate's 30 with normal effort. He's also very bright, and he weighs about 20 kgs. So stable or not stable? Yeah, so very stable. So, again, looking at this dog as exam his cardiovascular, respiratory, and systems are completely normal.

So this is a case where if we do a triage exam, and we go by just the exam, we're probably going to tell these owners, oh, Sammy, is very stable. You're going to have to wait. But we know, especially, if we know it's bromethalin, that timing is going to be crucial to having this dog have a good outcome. So making sure these cases don't accidentally get kind of pushed to the side and have to wait, but that this dog gets recognized that he ate a toxin that needs to be dealt with quickly.

So what was your initial plan for Sammy be? Yeah, so I would definitely do emesis, and then charcoal. There's a couple vitamin K and coag panel requests. So if you guys remember, bromethalin is not a vitamin K antagonist. It's actually a neurotoxic rodenticide. So it's going to be a little bit different with our treatment. So I would probably start with emesis and charcoal and then go from there.

And then I already kind of gave away the answer to this, but bromethalin is neurotoxic so we're worried about this dog developing neuro signs. So this is where the ingredients can be really helpful. A lot of the anti-coagulant rodenticides have crazy names that sound like bromethalin. R bromethalin is neurotoxic, and the prognosis if this dog develops clinical signs is really, really terrible. So we want to treat this dog as aggressively as possible, as

early as possible.



So for this dog, we would do charcoal. We make vomit. Charcoal every four to six hours because we know that bromethalin also undergoes enterohepatic recirculation. Fluids. Potentially baseline bloodwork. There's really not anything specific on bloodwork we're monitoring. If this is an older dog maybe, we just want to know about concurrent illness, but in a young dog maybe financially they're not sure what they can do. I probably wouldn't spend money on bloodwork. I'd probably just treat the dog as aggressively as possible. And then lipids. So bromethalin is actually lipophilic. So you can use lipids in these cases, as well, which makes me happy.

Bromethalin

- Neurotoxic
- Can be used in warfarin-resistant rats
- Increase in use?

Advisory: Bromethalin rodenticide – No known antidote

Robert Coppock

https://www.amazon.com/Tomcat-Bait-Chunx-Pail-LB/dp/B005BVODD2

So bromethalin is neurotoxic. So, again, if the owner has the container that's going to be the safest thing. And it basically is being used because a lot of rats develop resistance to warfarin, and they weren't being affected as much as they should have been.

And then in I think 2010 or 2011, the Environmental Protection Agency actually started banning some of the higher generation anti-coagulant rodenticides. So we saw an increase in use, which is really sad because, the anticoagulants have an antidote. We can give vitamin K in those animals and children typically have a fair to good prognosis. Bromethalin if you catch them early they usually do fine, but someone in the chat mentioned once they're a neuro, it's really hard to treat them, and a lot of the times the prognosis is going to be grave.

Toxic dose

- Acute oral LD_{50}
  - Cats are very sensitive
  - LD_{50} ~0.5 mg/kg vs. 5 mg/kg in dogs
- Clinical signs are seen at much lower doses
  - Cats ~0.2 mg/kg
  - Dogs ~1 mg/kg

https://animalcorner.org/blog/sad-cat/

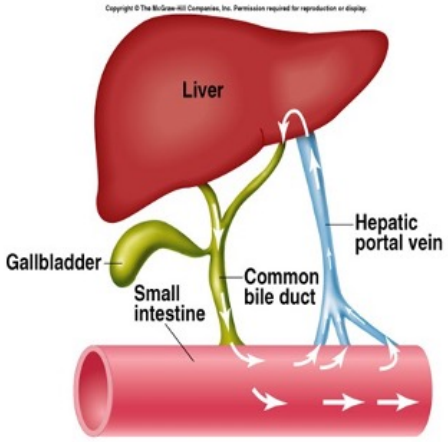
Cats are really, really sensitive. Again, cats are usually smarter, so we don't see it as often, but you can see that the dose in cats is going to be much, much lower. The LD 50 is 0.5 versus 5, and clinical signs are seen at much lower doses as well. So a question about is it ever too late to use or give lipids?

So if they're clinical, so if they come in and they're like scissoring and head pressing, and you're worried about increased intracranial pressure, it's too late. So really you want to catch these cases before they develop clinical signs, if you're going to use lipids. I would probably still try it honestly just because the prognosis is such garbage knowing that it's probably not going to do a whole lot.

So it's rapidly absorbed so within about four hours. So again, timing is really, really important. It's metabolized by the liver to a more toxic metabolite, and then distributed throughout the body. And then the highest concentration is actually in body fat.

Toxicokinetics

- Eliminated slowly
  - Half-life ~6 days
- Excretion occurs primarily through bile
  - Minimal urinary excretion
  - ***enterohepatic recirculation***



Your dog ate what?? Managing Toxicities

It's eliminated slowly, so the half life is really long. So six days and then it's excreted primarily through bile. So, again, this is when enterohepatic recirculation is going to be really, really important and treating them with charcoal is going to be important as well.

And question about do we always induce vomiting with bromethalin if below the toxic dose. And we do because there's two syndromes with bromethalin. There's one at the higher dose where they get seizures and they typically end up getting euthanized or dying. And then there's a syndrome they develop with a lower dose, where they can have kind of more insidious chronic neuro signs. So we would definitely treat them regardless of the amount.

And the problem with rodenticide, is it's really hard for owners to have, unless they know exactly how much was in the box and exactly how much is missing. It's usually a dog that gets into it somewhere else, and we don't know the exact toxic dose. So I would still definitely treat, especially because bromethalin is so terrible that the consequences can be really, really awful.

Mechanism of action

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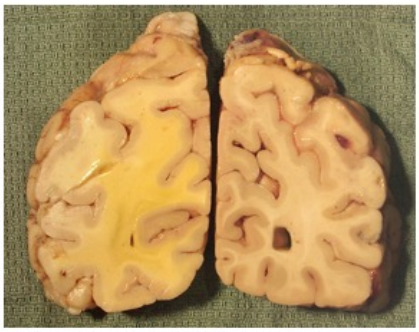
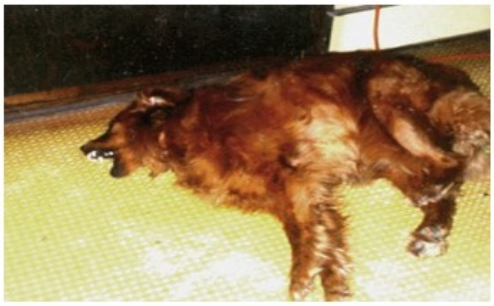
- Toxic effects due to uncoupling of oxidative phosphorylation
  - Inability of NaK ATPase pumps to function □ build up of intracellular sodium □ water moves into cells □ **cerebral edema**



So the bromethalin basically uncouples oxidative phosphorylation, a bunch of things happen. Sodium builds up in the cells, and then water moves into the cells and we get cerebral edema. And mostly affecting the CNS, because the brain is really dependent on oxidative phosphorylation. So, again, a primary neuro presentation.

Clinical signs

- Predominately associated with cerebral edema and increasing intracranial pressure (CNS)
  - Varies depending on amount
  - Varies depending on stage of intoxication



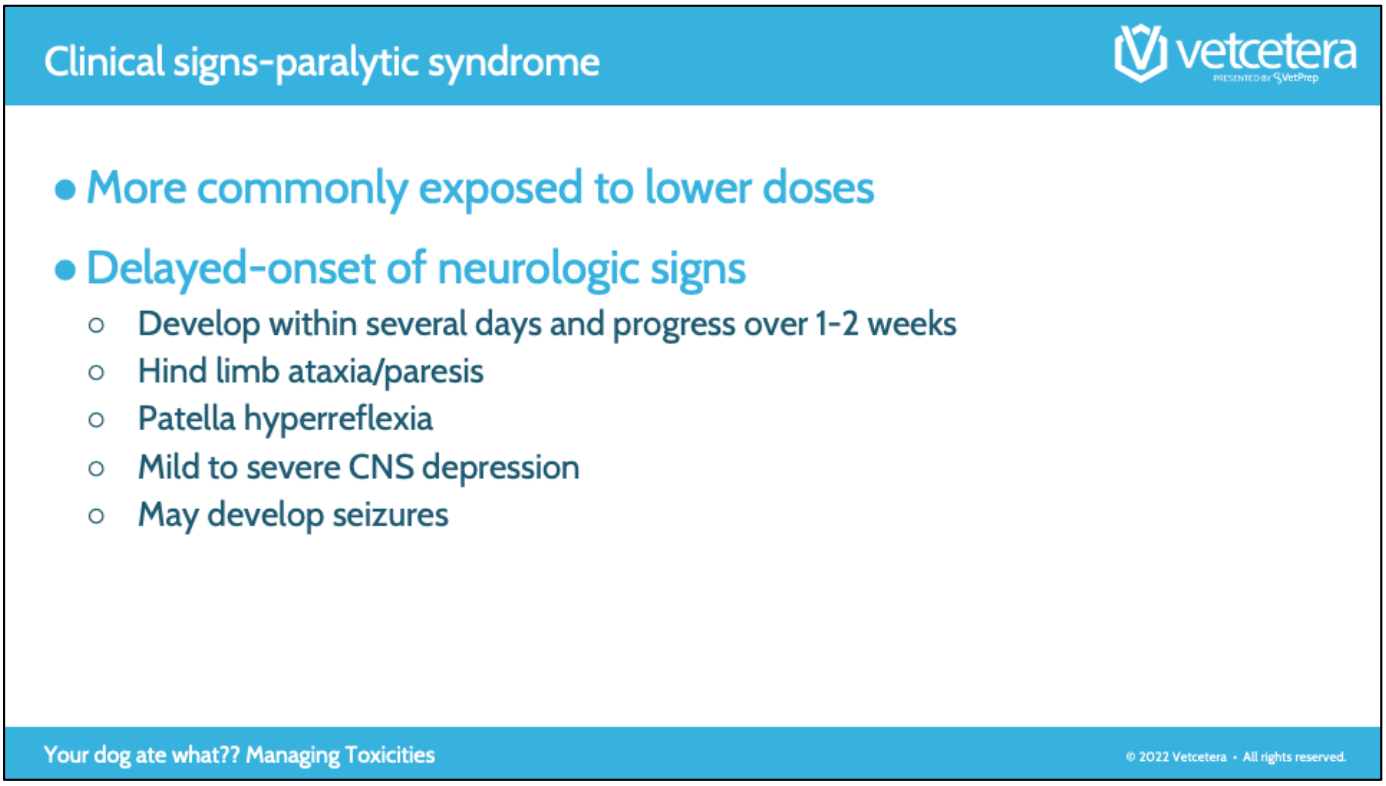
So these cases usually come in with cerebral edema and increased intracranial pressure. Really, it varies on the amount that they ate, and then the stage of intoxication kind of when they're coming in and what they look like clinically.

Clinical signs-convulsant syndrome

- Most animals asymptomatic for the first several hours
- Ingestion of > LD_{50}: develop clinical signs 2-24 hours after ingestion (acute-onset syndrome)
  - Sever muscle tremors
  - Hyperthermia
  - Seizures
  - Extreme hyper excitability
  - Hyperesthesia
  - **Poor to grave prognosis**

Most animals are asymptomatic.

So, again, this is when we want to catch them. This is the convulsion syndrome, so this would be at the higher doses. So they come in. They're normal. We want to be really aggressive. Treat them with emesis, charcoal, potentially lipids. They typically develop signs within 2 to 24 hours, and they're really, really severe. I've had a couple of cases come in and be seizuring and hypothermic. And typically it's a really, really poor to grave diagnosis, and almost always results in death whether it's natural or euthanasia. In terms of doses of charcoal, it's enterohepatic recirculation so I'd probably do it for about 48 hours if the owner was OK having the dog be hospitalized that long.

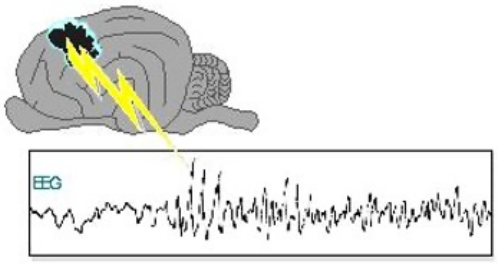


And then the other syndrome is a paralytic syndrome. So this is for cases that get a lower dose of exposure. So they don't typically get develop signs right away. It's going to be within a couple of days and actually progress over a couple of weeks. So we'd still want to treat these guys aggressively if we knew they got into it.

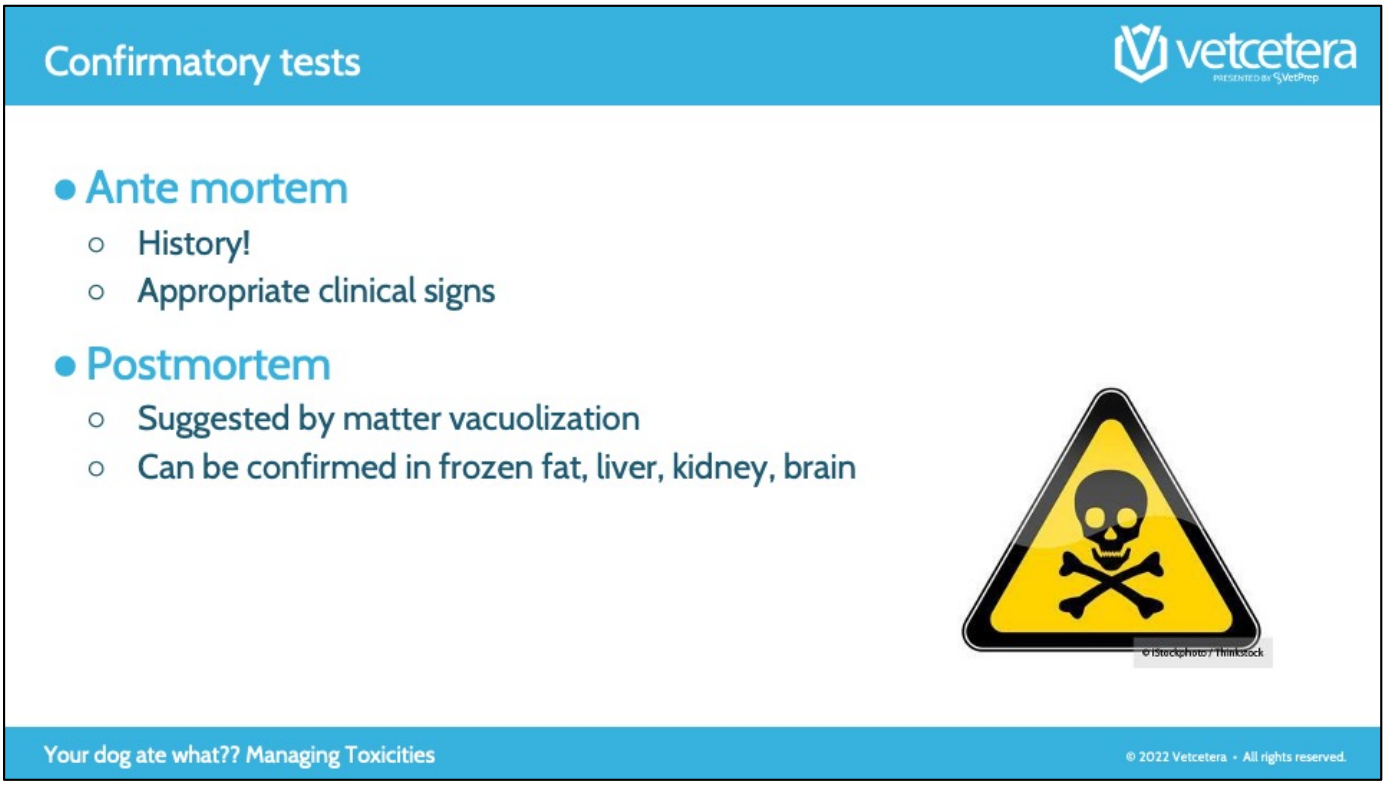
And then they can kind of have I would say unique and kind of almost random neuro signs. So they can have some hind limb changes. They can have patellar hyperplasia. Mild to moderate or severe excuse me CNS depression, and then maybe develop seizures. So potentially, again, pretty poor outcome. So I would say if you have a bromethalin dog, treat it aggressively and just assume it's a high dose that can cause those clinical signs.

Minimum database

- CBC/Chemistry
  - Typically unremarkable
- Electroencephalographic (EEG)
  - Not specific
  - Seizure foci
  - Cerebral hypoxia



Minimum database. So again if this is a really severe financial case, and it's a young dog like Sammy, otherwise healthy, and we really want to focus on the decontamination, there's nothing on blood work that's going to change what I'm doing, unless it's an older dog and they have a concurrent illness. You can do advanced things like an EEG. It's not going to be specific or anything that's going to, again, change what you're doing. So there's not going to really be a diagnostic test for bromethalin, unfortunately.



We're really going to rely heavily on history and appropriate clinical signs.

So for me a young dog comes in acutely neurologic. It's a dog maybe that's indoor or outdoor. Bromethalin it's going to be very high on my list, even if the owner doesn't-- a lot of owners don't ever think toxicities are possible. Obviously, they are. There is actually, you can test serum and fat for the metabolite. That's not a bad side test. It would be a send out test. Most of the time that would be a case where the owner is trying to prove maybe malicious intent by a neighbor or something like that, but you can do that. And then post-mortem. Again, on necropsy you can confirm it in different samples, and then certain things in the brain.

So for how to give charcoal in seizuring. I would want to control the seizures first. So I'd want to give whatever drug you're going to do midazolam, or keppra, or fino. And then probably at that point, it would have to be through an orogastric tube because that dog's is probably pretty sedate and not mentally appropriate, so if you're going to do charcoal at that point. If the dog's already seizuring, though, there might not be a ton of benefit from charcoal, just because if the dog's already clinical it's probably mostly been absorbed.

Treatment

- Reducing gastrointestinal absorption
- Providing symptomatic and supportive care

Given the long elimination time of bromethalin, what is your recommended duration of hospitalization of patients that remain asymptomatic? So, typically, I keep these cases for about 48 hours. And in that 48 hours, I'm doing fluids, repeated doses of charcoal. I've probably done a dose of lipids as well after I've made them vomit. And then if they're fine, they're probably fine at that point. I never guarantee that the dog won't develop those delayed neuro signs, but if they caught it really early and we were really aggressive, the ones I've seen have not had a problem.

So the treatment is really just, again, trying to reduce any absorption and then symptomatic and supportive care.

Treatment

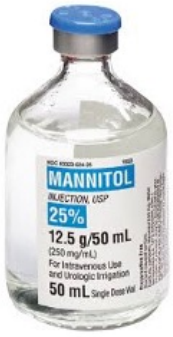
- Emesis
  - Only to alert, neurologically normal animals
- Activated charcoal
  - Orally or via orogastric tube
  - Repeat every 4-6 hours for at least 2-3 days
  - Close monitoring of electrolytes/hydration
- IV lipid therapy
- Ginkgo biloba?

For emesis, again, only to alert neurologically normal animals. If you're doing charcoal every four to six hours for at least two to three days orally, or again, in that case where maybe you have to treat with anticonvulsants doing it through an orogastric tube. If I'm doing repeated doses of charcoal, I really want to make sure I'm keeping up with hydration and keeping up with electrolytes, just because we know that can get very dehydrated and they can have some electrolyte changes.

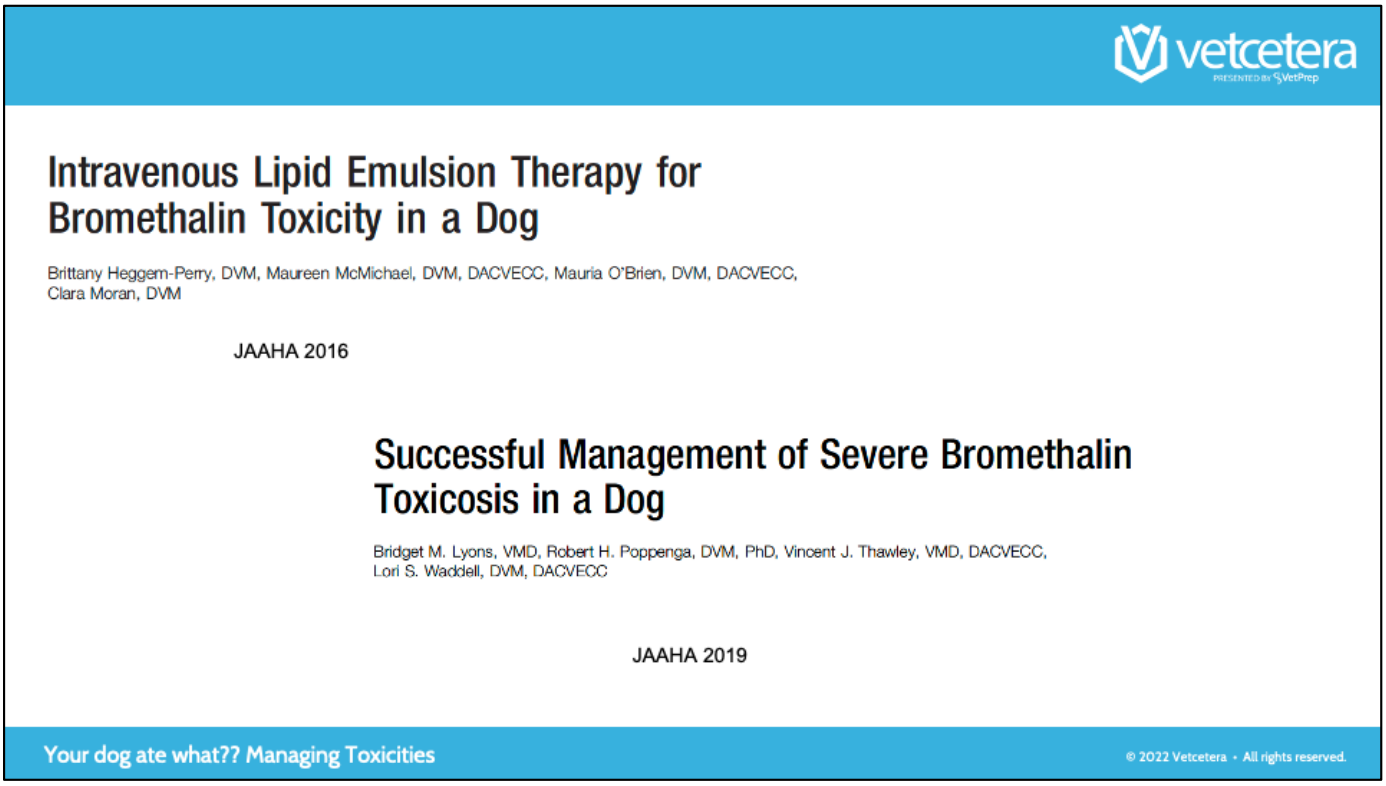
I'll usually do IV lipid therapy as well. Again, we know that the consequences of bromethalin are so terrible that to me it's worth it. And then there's actually some stuff in rats and one case report in dogs, where they gave ginkgo biloba extract to rats, and they had decreased clinical signs of bromethalin compared to the rats that got placebo. So kind of a random thing.

Treatment

- Control cerebral edema and elevated intracranial pressure
  - Mannitol, hypertonic saline
  - Keep head elevated 30 degrees
  - No jugular venipuncture
- Control seizures
  - Keppra
  - Phenobarbital (**lipophilic**)
  - Midazolam/diazepam/lorazepam PRN or CRI

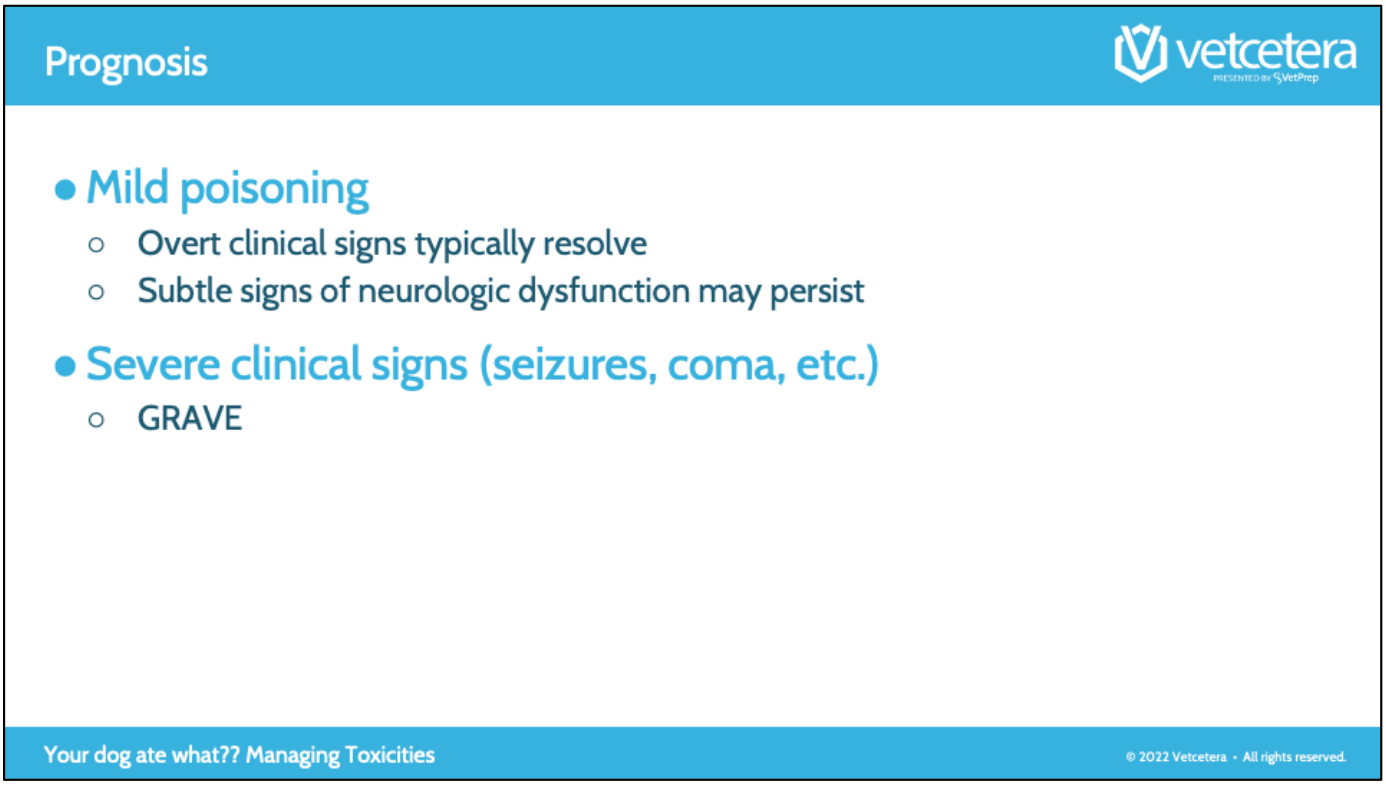


And then if they develop severe clinical signs of increased intracranial pressure, it's really just going to be treating supportively. Unfortunately again, the prognosis is not good. So you can try to treat intracranial pressure with things like mannitol or hypertonic saline, keep head elevated, 30 degrees, no jugular venipuncture. Control seizures. The big thing to think about is phenobarb is lipophilic, so if I give lipids, I'm probably going to remove the effects of phenobarb so maybe, choosing Keppra instead.



And then there's just a couple of case reports. There's not a ton out there on bromethalin, but the one on the top left, basically, it was a dog that they tried to make vomit, and the dog would not vomit. So they gave lipids and they actually measured the metabolite before and after lipids, and it went down tremendously. The dog didn't get clinical. And then the second dose was a really severe case that was actually significantly neurologic, and they were able to treat that dog with mannitol hypertonic saline lipids, and then they actually gave the dog ginkgo biloba and it lived. So most cases of severe bromethalin don't live, so that's pretty cool that they were able to do that.

So recommended fluid maintenance rate. There's a lot of different formulas. A lot of people just do 60 MLS per kg per day for dogs. That's totally reasonable in a regular sized dog. Then is there any value in utilizing hypertonic saline? Yeah. Yeah. So you could pick hypertonic or mannitol. I like hypertonic as a criticalist. There's probably not a huge difference. With either one, you really just want to keep up with hydration and perfusion. And then did that dog have residual neurologic deficits? I'm pretty sure I have to pull the paper and read the ending, but I'm pretty sure the dog was completely normal, which is even more impressive, but I can look and see because that's a good question, too.



So prognosis for mild poisoning. So for the dog ate a really low dose, the clinical signs typically resolve. They may have subtle signs persist, but again they'll probably resolve. If it's a severe case, so again, those dogs that come in seizuring, comatose. Those dogs have a really grave prognosis. Yeah, and hypertonic saline, I usually start with like 4 to 6 mLs per kg, so 5 is totally reasonable. If you remember it's going to pull a lot of fluid from the interstitium, and so it's going to make the dog actually clinically dehydrated. So giving just a regular isotonic crystalloids, like LRS or normal after the hypertonic to kind of replenish that fluid that you're dealing.

Resources

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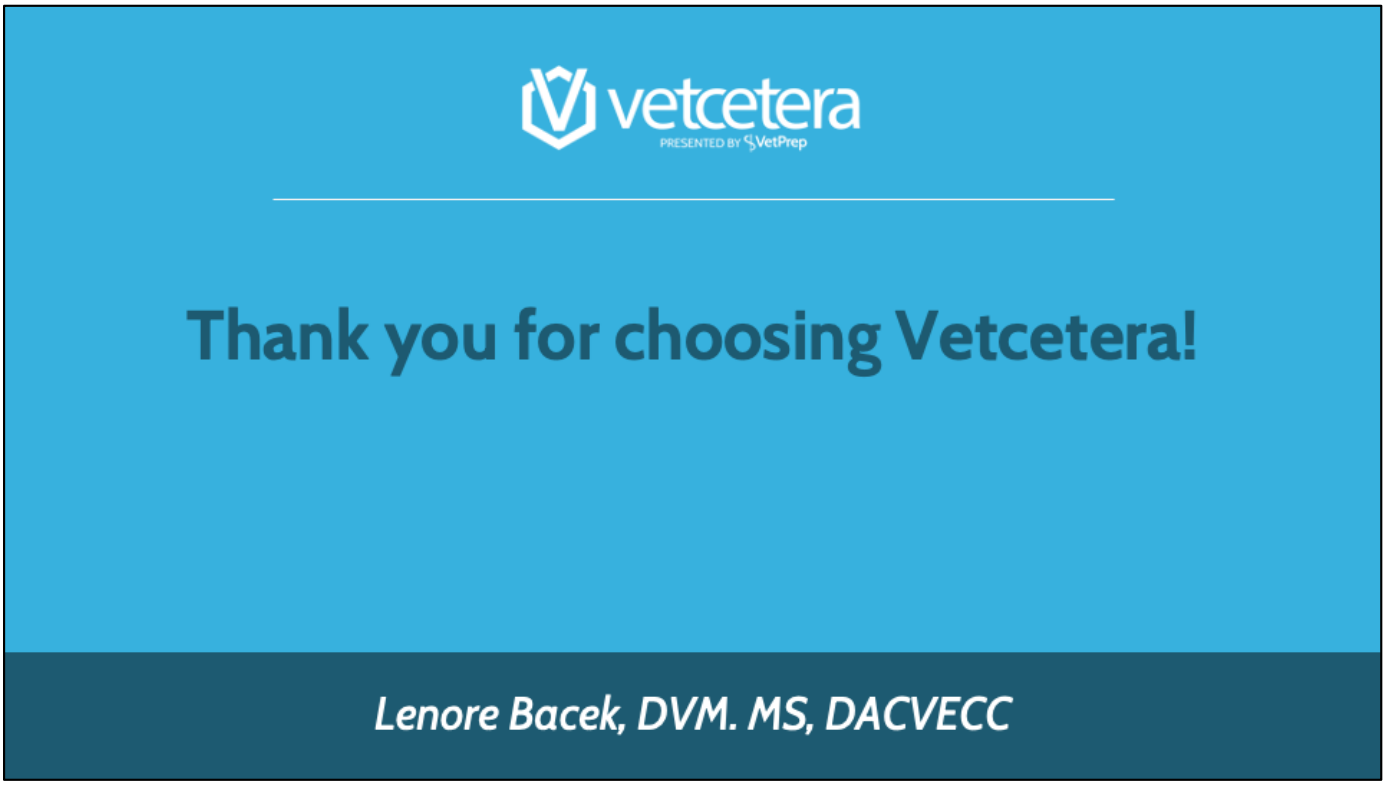
- ASPCA poison control
  - http://www.aspca.org/pet-care/poison-control/
  - (888) 426-4435
    - $60 consultation fee

ASPCA is a great resource. I believe it's still $60. I haven't called them in a little while, but it's totally worth it if it's a drug you're not familiar with. Again, especially with all the different meds that people are on, it can be helpful just to know what the best course of treatment is.



So thank you guys. Thanks for being chatty. It makes it more fun for me, too. If you guys have questions, feel free to email me. But hopefully this was helpful to everyone.

Yeah thank you so much. That was great. It was a lot of fun. I love the interaction, as well. This was a really great group. Thanks. Have a good night, everyone.

Bye. Thanks, Katie.

Bye.