NOW I'VE GOT A HEADACHE: TOXICOLOGY
TOP 10 HUMAN MEDICATIONS PETS GET INTO
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Human medications—both prescription and over-the-counter (OTC)—constitute 50% of the poisoning calls to animal poison control centers. This lecture will review common human medications that small animals ingest, including antidepressants, amphetamines, sleep aids, nonsteroidal anti-inflammatory drugs (NSAIDs) (e.g., ibuprofen, naproxen, aspirin, etc.), acetaminophen, vitamins and minerals, and cardiac medications. The mechanism of action of the toxicant, clinical signs, and treatment will be reviewed.

Decontamination
In veterinary medicine, the primary treatment for toxicant exposure should be decontamination and detoxification of the patient. The goal of decontamination is to inhibit or minimize further toxicant absorption and to promote excretion or elimination of the toxicant from the body. Decontamination can only be performed within a narrow window of time for most substances; therefore, it is important to obtain a thorough history and time since exposure. For further review on decontamination and specific treatment, attendees are referred to a veterinary toxicology book for more detailed review.

Selective Serotonin Reuptake Inhibitors (SSRIs)
Selective serotonin reuptake inhibitors (SSRIs) are a class of medications that are commonly used in human medicine for depression. Common examples include drugs like fluoxetine (Prozac in human beings; Reconcile in veterinary medicine), citalopram (Celexa), escitalopram (Lexapro), paroxetine (Paxil), and sertraline (Zoloft). Other similar drugs include selective norepinephrine reuptake inhibitors (SNRIs), which include common drugs such as duloxetine (Cymbalta), nefazodone (Serzone), and venlafaxine (Effexor). SNRI and SSRI drugs result in similar clinical signs of toxicosis, and therefore are treated the same. In veterinary medicine, SSRIs are used for a wide array of behavioral problems, including feline urine spraying, canine separation anxiety, lick granulomas, etc. These SSRI drugs work by blocking the reuptake of serotonin in the presynapse, thereby increasing the levels of serotonin in the presynaptic membrane. In small animal patients, common clinical signs from SSRIs include sedation or central nervous system (CNS) stimulation, anorexia, and lethargy, even at therapeutic doses. Increases in levels of serotonin, even in small doses, may lead to serotonin syndrome. Clinical signs of serotonin syndrome include CNS stimulation, vomiting, tremoring, seizures, hyperthermia (secondary to tremoring and seizuring), diarrhea, abdominal pain, and mydriasis. Treatment includes decontamination (ideally done by a veterinarian, due to the rapid onset of clinical signs), activated charcoal (AC), hospitalization for sedation (e.g., with acepromazine at 0.05 mg/kg, IV/IM PRN, or chlorpromazine), thermoregulation, intravenous (IV) fluid therapy, blood pressure and electrocardiogram (ECG) monitoring, muscle relaxants (for tremors; methocarbamol 22–100 mg/kg, IV), anticonvulsants (e.g., phenobarbital 4–16 mg/kg, IV), serotonin antagonists (e.g., cyproheptadine [1.1 mg/kg for dogs or 2–4 mg *total* per cat], p.o. or rectally q t.i.d.-q.i.d.), and supportive and symptomatic care.

Amphetamines
Amphetamines are used for a variety of medical and illicit reasons. Legal forms include prescription medications for attention deficit disorder and attention deficit hyperactivity disorder (ADD/ADHD), weight loss, and narcolepsy. Examples include dextroamphetamine and amphetamine (Adderall), D-amphetamine (Dexedrine), methamphetamine (Desoxyn), and lisdexamfetamine (Vyvanse). Illegal forms of amphetamines include street drugs like methamphetamine, crystal meth, and ecstasy. Drugs in this class act as sympathomimetic agents, meaning they stimulate the sympathetic system. Amphetamines also cause stimulation of α and β-adrenergic receptors and stimulate release of serotonin and norepinephrine; this results in increased catecholamine stimulation in the synapse. Amphetamines also increase release of serotonin from the presynaptic membrane, resulting in serotonin syndrome. With amphetamine toxicosis, secondary stimulation of certain body systems can result in significant clinical signs: CNS (e.g., agitation, mydriasis, tremors, seizures), cardiovascular (e.g., tachycardia, hypertension), GI (e.g., vomiting, diarrhea, hypersalivating), and respiratory (e.g., panting). Both clinical signs and treatment for amphetamine toxicosis are similar to SSRI toxicosis and include IV fluids, cooling measures, sedation (e.g., with acepromazine), muscle relaxants, anticonvulsants, thermoregulation, blood pressure monitoring, and symptomatic/supportive care.

Sleep Aids
Sleep aids, often benzodiazepines or non-benzodiazepine hypnotics, include drugs such as zolpidem (Ambien) and eszopiclone (Lunesta). These drugs work similarly to benzodiazepines (e.g., diazepam), as they potentiate GABA transmission, increasing frequency of chloride channel opening and resulting in inhibition of neuronal excitation. While these drugs result in sedation in humans, up to 40% to 50% of dogs ingesting toxic doses of sleep aids develop paradoxical CNS stimulation rather than expected depression. Clinical signs include CNS depression (e.g., depression, ataxia, weakness, paresis), CNS stimulation (e.g., hyperactivity, anxiety, agitation, panting, tremors), or other signs, such as nausea, vomiting, diarrhea, and hyperthermia (Lancaster et al. 2011). Treatment includes decontamination, activated charcoal, and for those patients demonstrating signs of CNS stimulation, the use of sedatives or anxiolytics (e.g., acepromazine at 0.05 mg/kg, IV, IM PRN). In patients exhibiting CNS stimulation, benzodiazepines (e.g., diazepam IV) should *not* be used, as they may worsen the symptoms. Rather, the use of phenothiazines (e.g., acepromazine, chlorpromazine) or barbiturates (e.g., phenobarbital IV) should be used instead. In severe cases of respiratory or cardiac depression, the use of flumazenil, the reversal agent for benzodiazepines, can be considered.

Nonsteroidal Anti-Inflammatory Drugs (NSAIDs):
Ibuprofen, Naproxen, Aspirin
NSAIDs are competitive inhibitors of prostaglandin synthesis (cyclooxygenase or "COX" inhibitors) and result in decreased prostaglandin, which is important for normal homeostatic function (including maintaining renal blood flow, maintaining mucus production in the stomach, etc.). Common OTC human NSAIDs include active ingredients such as ibuprofen and naproxen sodium. Examples of human NSAIDs include Advil, Aleve, certain types of Motrin, etc. With NSAID toxicosis, the GI tract, kidneys, CNS, and platelets can be affected. Cats and certain breeds of dogs (e.g., German shepherds) seem to be more sensitive to NSAIDs than others and should be treated aggressively. With cats, severe acute renal failure (ARF) is often more clinically seen with NSAID toxicosis at lower doses (as compared to dogs). With dogs, signs secondary to GI ulceration (e.g., vomiting, diarrhea, melena, hematemesis, etc.) are more commonly seen initially, followed by secondary ARF.

With NSAID toxicosis, it is important to keep in mind that each NSAID has a different toxic dose, margin of safety, half-life, and route of excretion, and an animal poison control should be contacted to identify what specific NSAID and toxic dose was ingested. For example, in dogs, ibuprofen results in GI signs at doses as low as 16–50 mg/kg, while severe GI signs may be seen at 50–100 mg/kg. Renal compromise may be seen at doses of 100–250 mg/kg (resulting in potential ARF), and fatalities have been reported at doses > 300 mg/kg. This differs tremendously from naproxen sodium (dogs), where severe clinical signs can be seen at doses as low as 5 mg/kg (Syring 2010). With naproxen, experimental canine doses of 22 mg/kg orally once a day for 3 days have resulted in perforation of the GI tract with secondary septic peritonitis occurring.

Clinical signs of NSAID toxicosis include anorexia, vomiting, hematemesis, diarrhea, melena, abdominal pain, lethargy, malaise, uremic halitosis, dehydration, etc. Treatment includes decontamination, the use of activated charcoal (often multiple doses due to enterohepatic recirculation, if appropriate), GI protectants (e.g., H_2 blockers, sucralfate, omeprazole, misoprostol, etc.), aggressive IV fluid therapy (to help maintain renal blood flow), antiemetic therapy, and symptomatic and supportive care. With high doses, anticonvulsants may also be necessary if CNS signs develop (albeit rare). Animals ingesting nephrotoxic doses of NSAIDs should have baseline blood work (e.g., complete blood count, chemistry, urinalysis, urine specific gravity) performed at presentation (prior to the administration of any fluids). A daily renal panel, packed cell volume (PCV), and total protein (TP) should be performed daily for the first 2 to 3 days of hospitalization.

Acetaminophen
Acetaminophen (N-acetyl-p-aminophenol), a COX-3 inhibitor, is a popular OTC analgesic and antipyretic medication used frequently in humans. It is not considered a true NSAID as it lacks anti-inflammatory properties. Normally, part of this drug is metabolized into nontoxic conjugates via the metabolic pathways (glucuronidation and sulfation); some is metabolized into the toxic metabolite N-acetyl-para-benzoquinoneimine (NAPQI) via the cytochrome P-450 enzyme pathway. Typically, NAPQI is detoxified by conjugation with glutathione in the liver. Toxicosis occurs when glucuronidation and sulfation pathways are depleted; this results in toxic metabolites building up and secondary oxidative injury occurring. While this drug is very safe for human use, it has a narrow margin of safety in dogs and cats; the severity of toxicosis and development of clinical signs is species-dependent.

Cats have an altered glucuronidation pathway and a decreased ability to metabolize acetaminophen, making them much more susceptible to toxicosis. In cats, red blood cell (RBC) injury is more likely to occur in the form of methemoglobinemia (metHb), and toxicity can develop at doses as low as 10 mg/kg. In cats, lethargy, swelling of the face or paws, respiratory distress, brown mucous membranes, cyanosis, vomiting, and anorexia may be seen secondary to metHb. In dogs, hepatic injury is more likely to occur; acetaminophen toxicosis can occur at doses > 100 mg/kg, while metHb can develop at doses of > 200 mg/kg (Babski and Koenig 2010).

Dogs may develop clinical signs of keratoconjunctivitis sicca (dry eye), malaise, anorexia, hepatic encephalopathy, vomiting, melena, and icterus secondary to hepatotoxicity. Treatment includes decontamination, administration of activated charcoal, antiemetic therapy, IV fluid therapy, treatment for hypoxemia (e.g., oxygen, blood transfusion, etc.), antioxidant therapy (e.g., vitamin C), provision of a glutathione source (S-adenosyl-methionine, or SAMe), and the antidote n-acetylcysteine (NAC, ideally IV) to limit formation of the toxic metabolite NAPQI by providing additional glutathione substrate. Baseline blood work and follow-up biochemical panels should be performed to monitor for the presence of metHb, Heinz body anemia, or evidence of hepatotoxicity. Generally, prognosis is fair with therapy. If clinical signs resolve and liver enzymes are within normal limits after 48 hours of NAC therapy, patients can be discharged with SAMe (for 30 days). Those with severe hepatic failure have a poorer prognosis.

Decongestants

Cold and flu medications (e.g., Claritin-D) often carry decongestants such as pseudoephedrine (PSE) and phenylephrine (PE). The exact mechanism of how these drugs work is unknown but they are thought to stimulate alpha- and beta-adrenergic receptors by releasing norepinephrine. PE is typically considered to be less toxic than PSE, as it is less bioavailable with oral ingestion. Clinical signs seen with decongestant ingestion include cardiac (e.g., tachycardia, hypertension, reflex bradycardia), CNS (e.g., mydriasis, agitation, trembling, seizures), and various miscellaneous signs (e.g., hyperthermia). With PSE, moderate to severe clinical signs can be seen at 5–6 mg/kg, while death has been reported at 10–12 mg/kg. With PE, similar clinical signs can be seen, although GI signs, such as vomiting, are the most common signs observed. Treatment includes decontamination (if appropriate), administration of one dose of charcoal with a cathartic, IV fluid therapy (to enhance urinary elimination), blood pressure monitoring, antiemetics, sedatives/anxiolytics (e.g., acepromazine), muscle relaxants for tremoring (e.g., methocarbamol 22–100 mg/kg, IV PRN), anticonvulsants (e.g., phenobarbital 4–6 mg/kg, IV, PRN), and rarely, antihypertensives (e.g., hydralazine).

Cholecalciferol and Vitamin D_3 Products

Ingestion of toxic levels of activated vitamin D_3 (commonly found in omega fatty acid and fish oil supplements or multivitamins, both OTC and prescription formulations) can result in severe hypercalcemia and hyperphosphatemia, with secondary ARF developing as a result of soft-tissue mineralization to the renal tubules. (Another source of vitamin D_3 is in the topical human prescription medication calcipotriene, which is used for psoriasis.)

With vitamin ingestions, doses of vitamin D_3 > 0.1–0.5 mg/kg can result in clinical signs and hypercalcemia, respectively. Typically, clinical signs often do not develop for 2 to 3 days when the patient has already developed clinical signs of ARF. Clinical signs and clinicopathologic findings include increased thirst and urination, weakness, lethargy, anorexia, vomiting, generalized malaise, uremic halitosis, dehydration, hypercalcemia, hyperphosphatemia, and azotemia. Treatment for cholecalciferol or vitamin D_3 toxicosis includes aggressive IV fluid therapy to promote calciuresis (e.g., specifically with 0.9% NaCl, which enhances calciuresis), the use of medications to increase calciuresis (e.g., prednisone, furosemide), and medications to prevent hypercalcemia (e.g., pamidronate, calcitonin) (Adams 2010). Treatment is often expensive and requires hospitalization for an extended period of time (e.g., 3 to 7 days). Most patients are discharged on oral furosemide and prednisone for weeks. Frequent monitoring of renal function and electrolytes is imperative. Calcium, phosphorous, BUN, creatinine, and ionized calcium should be evaluated every 12 to 24 hours while the patient is hospitalized, and then every 2 to 3 days thereafter for the next 2 weeks. This will allow one to assess the ability to titrate the prednisone and furosemide therapy and to ensure that the patient does not develop secondary ARF. Even with aggressive treatment, chronic renal failure may be a secondary sequela.

Cardiac Medications

Cardiac medications include broad categories such as calcium channel blockers (CCB), beta blockers (BB), and angiotensin-converting enzyme (ACE) inhibitors. These medications are commonly used in both human and veterinary medicine to treat underlying cardiac disease or hypertension. Each category of cardiac medication has a different margin of safety. Calcium channel blocker and beta-blocker toxicosis should be treated aggressively, as

these two categories of medications have a narrow margin of safety. Toxicosis of these agents can result in myocardial failure, severe bradycardia, and hypotension; untreated, cardiac output becomes reduced, and secondary severe hypoperfusion and ARF can potentially develop (Syring and Engebretsen 2010; Engebretsen and Syring 2010). In general, there is a wider margin of safety with ACE inhibitors. With ACE inhibitors, severe overdoses can cause hypotension, dizziness, weakness, and hypotension. Pets ingesting small amounts of ACE inhibitors can potentially be monitored at home, unless they have underlying disease (e.g., kidney failure, cardiac disease, etc.). With ACE inhibitors, ingestions > 10–20 times a therapeutic dose are generally considered toxic and can result in severe clinical symptoms (e.g., hypotension) (Adams 2010). Treatment for toxic ingestions of cardiac medications includes decontamination (e.g., emesis induction, gastric lavage, activated charcoal administration), blood pressure monitoring, aggressive IV fluid therapy if hypotension is detected, electrocardiogram monitoring, atropine, and blood work monitoring. With severe toxicosis, the use of temporary pacemakers, high-dose insulin therapy, or intravenous lipid emulsion may be warranted as a potential antidote for CCB toxicosis (Syring and Engebretsen 2010).

Asthma Inhalers (e.g., Albuterol)

Asthma inhalers are often used in both human and veterinary medicine. Various types of medications may be used, including steroids (e.g., fluticasone) or beta agonists (e.g., albuterol, salbutamol, etc.). When beta-agonist inhalers are accidentally chewed and punctured by dogs, they can result in a severe, life-threatening, acute toxicosis. Because inhalers often contain 200 metered, concentrated doses, a massive amount of drug is released with just one puncture. Clinical signs include cardiac (e.g., tachycardia, a "racing heart rate" per the owner, injected gums, hypotension, hypertension, severe arrhythmias), electrolyte changes (e.g., severe hypokalemia, hyperglycemia), GI (e.g., vomiting), and CNS (e.g., mydriasis, agitation, weakness, collapse, death). Treatment includes stat electrolyte monitoring, IV fluids, potassium supplementation, blood pressure and ECG monitoring, sedation/anxiolytics (if the patient is agitated, hypertensive, and tachycardiac), anti-arrhythmics such as beta-blockers (e.g., propranolol, esmolol, etc.), and symptomatic supportive care. Treatment for 24 to 36 hours is typically necessary, until clinical signs resolve.

Conclusion

Pet owners should be appropriately educated on how to pet-proof the house and on the common human medications that are highly poisonous to their pets. Pet owners should also be appropriately educated on crate training to help minimize toxin exposure. Once a pet is exposed to a toxicant, it is imperative for us to be able to determine whether emesis is appropriate and to understand when it may be contraindicated (e.g., symptomatic patient, delayed time since exposure, hydrocarbons, etc.). Knowledge of the underlying mechanisms of action, the pharmacokinetics (including absorption, distribution, metabolism, and excretion), and the toxic dose of the toxicant is imperative in determining appropriate decontamination and therapy for the patient.

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Top 10 Human Medications Poisonous to Pets. Pet owners who are serious about pet-proofing their home should start with their own medicine cabinet. Nearly 50% of all calls received by Pet Poison Helpline involve human medications â€“ both over-the-counter and prescription.Â Pets â€” especially dogs â€” get underactive thyroids too. Interestingly, the dose of thyroid hormone needed to treat dogs is much higher than a personâ€™s dose. Therefore, if dogs accidentally get into thyroid hormones at home, it rarely results in problems. However, large acute overdoses in cats and dogs can cause muscle tremors, nervousness, panting, a rapid heart rate and aggression. Cholesterol lowering agents (e.g. Lipitor, Zocor, Crestor). My head's killing me (idiom): I've got a very bad headache. a hangover (n): a headache from drinking a lot of alcohol. a fry-up (n, informal): a meal made of fried foods (fried egg, mushrooms, bacon etc.) to burn the midnight oil (idiom): to study or work until late at night. Who's for...? (offer, informal): Who wants...? You're a pain in the neck (idiom): You're very annoying. Most Recent. Last 3 episodes. Weâ€™ve all had toxic people dust us with their poison. Sometimes itâ€™s more like a drenching. Know these 12 signs to avoid falling under the influence.Â This is particularly common in workplaces or relationships where the balance of power is out. â€˜Iâ€™ve left that six monthsâ€™ worth of filing for you. I thought youâ€™d appreciate the experience and the opportunity to learn your way around the filing cabinets.â€™ Or, â€˜Iâ€™m having a dinner party. Why donâ€™t you bring dinner. For 10. Itâ€™ll give you a chance to show off those kitchen skills. K?â€™ Review and cite TOXICOLOGY protocol, troubleshooting and other methodology information | Contact experts in TOXICOLOGY to get answers.Â We have captured some small fishes from pond but they could not survive even for a day in jar (Open from top). So here we are searching from some practical approach for collecting them and ensuring their survival too. Thank You. If you get occasional tension-type headaches, you can take care of them yourself. Over-the-counter pain relievers such as acetaminophen (Tylenol, other brands) and nonsteroidal anti-inflammatories (NSAIDs) such as aspirin, naproxen (Aleve, other brands), or ibuprofen (Motrin, Advil, other brands) often do the trick, but follow the directions on the label, and never take more than you should. A heating pad or warm shower may help; some people feel better with a short nap or light snack. If you get frequent tension-type headaches, try to identify triggers so you can avoid them. Don't get ov...Â And don't fall into the trap of overusing medications; for some gents, rebound headaches are the biggest pain of all. Share this page: Share this page to Facebook.