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DOC, WHAT DID HE GET INTO? EMERGENCY APPROACH TO TOXINS

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The presentation of a patient with abnormal clinical signs secondary to accidental or malicious exposure to toxins is often a diagnostic challenge for the veterinary practitioner. When the toxin is known, the treatment plan is much easier rather than empirically treating clinical signs secondary to an unknown toxin. Having a specific toxin questionnaire that includes the following questions may jog a client's memory or help guide you in making an accurate diagnosis and formulating an accurate treatment plan. What? How much? When or how long ago? What types of clinical signs has the animal been demonstrating since being exposed to the toxin? Did the patient vomit after ingestion? Did you see any of the substance in the vomitus? Does the animal have any other medical problems? Is your animal currently taking any prescription or over-the-counter medications?

While the client is filling out the toxin questionnaire, the veterinarian should be simultaneously evaluating the patient's clinical status by performing the physical examination. As with all others, the important concepts of airway, breathing, and circulation apply to toxicity patients. Make sure that animal has a clear airway, and is able to breathe adequately. Evaluate the patient's circulatory status, taking particular note of the pulse quality, mucous membrane color, capillary refill time, heart rate, and heart rhythm. After the patient's temperature, pulse, and respiration are noted, the patient's blood pressure and electrocardiogram should be evaluated.

Patients that are obviously having seizures or are severely obtunded should promptly be treated with supportive care. Seizures can symptomatically be treated with intravenous diazepam (0.5–2.0 mg/kg) AFTER blood samples for complete blood count and serum biochemical analysis, whenever possible. Diazepam is dissolved in a propylene glycol carrier that can interfere with some diagnostic tests, including some assays for ethylene glycol. Vascular access is extremely important, as the patient's clinical condition can deteriorate rapidly. An intravenous catheter should be placed, and crystalloid fluids administered as determined by the patient's temperature, hydration, and cardiovascular variables.

DERMAL OR OCULAR EXPOSURE

Dermal or ocular exposure to a toxin causes a variety of signs that ranges from mild skin or conjunctival irritation to severe full-thickness skin injury or blindness, depending on the type of irritant and duration and anatomic location of exposure. Alcohol compounds and detergents often cause mild irritation and inflammation, whereas strong acids and alkaline substances cause more serious damage to the deeper tissues. In cases of ocular exposure to toxins, treatment consists of irrigating and rinsing the eyes and periorbital tissues starting immediately after exposure, prior to transporting the patient to the hospital. Rinsing the eyes with tap water or isotonic crystalloid fluids such as normal (0.9%) saline or lactated Ringer's solution should be used to rinse the exposed/affected area for a minimum of 30 minutes after exposure. Attempts at neutralizing acidic or alkaline compounds with other chemicals can potentially cause a hyperthermic reaction that causes further tissue damage, and therefore should not be attempted. In the case of dermal exposure, powdered substances can be vacuumed off of the patient prior to bathing. Liquid substances can be rinsed with tap water and then cleaned with dishwashing liquid until all of the material has been removed. Highly viscous substances often need to be removed by shaving the fur, then bathing the underlying skin. Petroleum-based products such as turpentine, gasoline and other oils can increase the absorption of some toxins, and should not be used routinely for decontamination.

GASTRIC DECONTAMINATION

If an animal has ingested a toxic substance, the goals of gastric decontamination are to first remove the substance from the stomach and then to prevent further absorption whenever possible. Methods to hasten elimination of the toxin from the body should be considered next. Finally, if the toxin is known, specific antidotes can sometimes be administered when available. In many cases, however, the patient's treatment is largely supportive and empiric, and consists of treating abnormal clinical signs and not the specific toxin per se. The type of decontamination strategy largely depends on the patient's neurologic status at the time of presentation and the nature of the substance ingested. If an animal is alert and has a normal gag reflex with no outward neurologic signs, induction of emesis is usually an appropriate method to eliminate all or a portion of the toxin from the body before it is absorbed. In other cases, such as with petroleum-based substances or severely acidic or alkaline substances, emesis is absolutely contraindicated due to the risk of causing aspiration pneumonitis or erosive esophagitis. Intravenous or conjunctival apomorphine (0.04 mg/kg) can be administered to induce emesis. If more than 2 hours has passed since the ingestion of the toxin, emesis may not be worthwhile. Syrup of ipecac, mustard powder, table salt, and dishwashing liquid have been previously recommended for the induction of emesis, but are not as effective at inducing vomiting, and can sometimes cause more harm than good and therefore should not be used. Expired and concentrated ipecac solutions, for example, can cause cardiac dysrhythmias, and thus, should not be recommended to clients. Hydrogen peroxide can be administered as a 3% solution at 1–2 ml/kg (1 teaspoon per 10 pounds) orally. In cats, xylazine can be administered at 0.44 mg/kg IV. When necessary, sedation caused by the xylazine can be reversed with yohimbine.

If attempts at emesis induction are unsuccessful, or if a patient does not have an intact gag reflex (ie, severely obtunded, seizures, or comatose patient), orogastric lavage should be performed. The patient should be placed under general anesthesia with a cuffed endotracheal tube in place to decrease the risk of iatrogenic aspiration pneumonia. In rare cases, the patient can have an orogastric and endotracheal tubes placed without additional sedation. In most cases, however, diazepam (0.2–0.6 mg/kg IV) with fentanyl (10 µg/kg IV) or propofol (4–7 mg/kg IV) can be administered, followed by inhalant anesthesia (isoflurane or sevoflurane) for maintenance. Perianesthetic monitoring should include pulse oximetry, invasive or noninvasive blood pressure, ECG, and capnometry.

Following endotracheal intubation, the orogastric tube should be measured from the tip of the nose to the level of the last rib. A piece of tape should be marked to note how far to insert the tube. The tip of the tube should be lubricated with a lubricant such as dextrose solution or K-Y jelly, and then gently passed through a tube of 2-inch tape secured behind the canine teeth. This technique helps to prevent the mouth from closing and kinking or damaging the orogastric tube. It is sometimes helpful to also use a mouth gag. The stomach should then be lavaged with a water pump and warm tap water, alternating between instilling warm water then allowing the gastric contents to flow from the stomach via the orogastric tube into a separate bucket. A sample of the gastric contents should be refrigerated or frozen for possible later analysis, if the toxin is unknown. The stomach should be lavaged until the fluid runs clear and there is no further evidence of gastric material. When indicated, activated charcoal can be administered through the orogastric tube and flushed into the stomach with small amounts of water. When removing the orogastric tube, the tube should then be kinked, then quickly removed to prevent leakage of any fluid in the tube into the trachea during tube removal. The patient should be awakened slowly and the endotracheal tube cuff left inflated for as long as possible until the patient is definitely able to protect their airway to prevent aspiration pneumonia.

INTRAVENOUS FLUIDS

Intravenous fluid therapy should be considered for several reasons. First, IV fluids should be administered to maintain hydration and normal cardiovascular function. Some toxins cause vomiting and diarrhea, and thus affected patients are prone to dehydration without supportive care. Second, intravenous fluids can aid in diuresis and hasten elimination of the toxic compound from circulation. As a general rule of thumb, 2–3 times the calculated maintenance fluid volumes should be administered per hour, provided that there is no evidence of volume overload (tachypnea, pulmonary crackles, or chemosis). In some cases, elimination of the substance can be hastened using peritoneal dialysis. Peritoneal dialysis consists of placing a large bore catheter or rubber tube into the patient's abdominal cavity, then infusing hypertonic dextrose-containing fluids to remove the toxin across the peritoneal membrane by osmosis. Several readily dialyzable substances that are commonly encountered in veterinary patients include barbiturates, ethylene glycol, and salicylates.

ANCILLARY TREATMENT

If the toxin is known, specific antidotes should be administered when available. For example, in cases of ethylene glycol intoxication, 4-methylpyrazole (4-MP) or a dilute ethanol solution can be used to inhibit the conversion of ethylene glycol to its toxic metabolites. Naloxone can be used to reverse an inadvertent overdose of a narcotic, including ingestion of a fentanyl patch or heroin. Supportive care measures should always be implemented in order to maintain the patient's hydration status, heart rate, blood pressure, respiratory function, body temperature, and urine output, irrespective of whether the toxin is known or can be reversed with an antidote. Since many toxins can cause cardiac and respiratory depression, respiratory monitoring including arterial blood gas analyses, pulse oximetry and capnometry should be performed to make sure the patient is oxygenating and ventilating adequately. In severely obtunded patients, passive range of motion exercises and frequent turning should be performed to prevent disuse atrophy, peripheral edema, decubital ulcers, and positional atelectasis. The mechanisms of action, clinical signs of intoxication, decontamination, and therapies for newer and emerging toxins, including raisin and grape toxicity, macadamia nuts, methamphetamines, and selective serotonin uptake inhibitors, are discussed below.

NEWER EMERGING TOXICITIES

Macadamia Nuts

Macadamia nuts have recently been identified as a cause of toxicity in some dogs. Within hours of ingestion, clinical signs associated with macadamia nut toxicosis include ataxia, ascending paralysis, severe tremors, vomiting, and hyperthermia. Treatment is largely supportive in nature following gastric decontamination, and includes intravenous fluids, methocarbamol to treat tremors and prevent hyperthermia, and antiemetics (dolasetron, metoclopramide) to treat nausea and vomiting. In experimental cases, all dogs made a complete recovery within 76 hours of onset of clinical signs and initiation of supportive care.

Raisins and Grapes

Ingestion of even small quantities of raisins and grapes (0.32–0.65 oz/kg) has been associated with the development of acute tubular necrosis and renal failure in some dogs. The toxic principle remains unknown, but is thought to involve some form of mycotoxin. To date, this theory remains unproven despite analysis of both raisins and grapes from affected patients. Clinical signs associated with raisin and grape toxicity typically occur within 48 hours of ingestion, and include nausea, vomiting, inappetence, polyuria, polydipsia, progressing

to anuria. Raisins and grapes are often visible in the vomitus and feces of affected patients. Treatment is supportive, and includes administration of intravenous crystalloid fluids, antiemetics, H_2 receptor antagonists, and amlodipine or diltiazem to treat systemic hypertension. If oliguria or anuria is present peritoneal dialysis has been an effective support measure until renal tubular obstruction resolves, and urine output improves.

Selective Serotonin Reuptake Inhibitors

Selective serotonin reuptake inhibitor drugs are most commonly prescribed for depression, obsessive-compulsive disorder, and anxiety in humans. The most commonly prescribed drugs in this class include Prozac (fluoxetine), Paxil (paroxetine), Zoloft (sertraline), and Luvox (fluvoxamine). In dogs, even small doses can lead to serious clinical signs. Selective serotonin reuptake inhibitors (SSRI) are rapidly absorbed from the digestive tract, with peak serum concentrations occurring 2–8 hours after ingestion. The elimination half-life for each drug differs in dogs, but typically last 16–24 hours. SSRIs inhibit the reuptake of serotonin, causing serotonin to accumulate in the brain. The resultant "serotonin syndrome" is characterized by trembling, seizures, hyperthermia, ptyalism or hypersalivation, cramping or abdominal pain, vomiting, and diarrhea. Other clinical signs of SSRI intoxication include depression, tremors, bradycardia or tachyarrhythmias, and anorexia. If the patient is not depressed and has an intact gag reflex, treatment of suspected SSRI intoxication involves gastric decontamination with intravenous apomorphine (0.04 mg/kg IV) as the treatment of choice. Hydrogen peroxide can potentially cause the ingested material to dissolve more rapidly and be absorbed more quickly.

In patients that are unable to protect their airways, rapid sequence anesthetic induction with propofol (4–7 mg/kg IV) followed by endotracheal intubation and orogastric lavage should be performed. Activated charcoal can also be administered to prevent further toxin absorption and hasten elimination from the GI tract. Other clinical signs should be treated symptomatically. Seizures can be treated with intravenous diazepam (0.5–1 mg/kg IV). Tachyarrhythmias can also be treated according to type. For example, ventricular dysrhythmias can be treated with intravenous lidocaine (1–2 mg/kg IV, followed by a constant rate infusion of 50–100 µg/kg/minute). Tachycardia (sinus or supraventricular) can be treated with intravenous beta-blockers including propranolol (0.02 mg/kg IV) and esmolol (200–500 µg/kg IV) to effect. The skeletal muscle relaxant methocarbamol (55–220 mg/kg IV to effect, not to exceed 330 mg/kg/day) can be used to control muscle tremors. The serotonin antagonist cyproheptadine (1 mg/kg) can be dissolved in water and administered per rectum. Rectal administration will allow the drug to be absorbed quickly before the activated charcoal reaches the colon, and will be able to block the action of the SSRI, treating or preventing serotonin syndrome. Any animal that has ingested an SSRI should be promptly treated and carefully observed for at least 72 hours for adverse side effects.

References available from the author upon request.