Managing the intoxicated patient

Intoxication, or suspicion of intoxication, is a relatively common presentation in dogs and cats, so knowing how to manage the patient is important, writes Karen Humm MA VetMB CertVA DACVECC DipECVECC FHEA MRCVS, lecturer in small animal emergency and critical care, The Royal Veterinary College, UK

A diagnosis of intoxication is generally made in one of two ways. Firstly, owners may present their dog with known and (generally) recent ingestion of a toxin. A diagnosis may also be made when a disease process is being investigated and the possibility of toxicity is raised with the owners, eg. acute kidney injury is diagnosed and owners are questioned about whether a dog may have had access to grapes.

There are many different toxins, with many different effects on the patient, but the basic treatment approach is the same. With emergency stabilisation, decontamination, antidote administration and supportive care provide the basis of successful management.

INITIAL STABILISATION AND TREATMENT

Any cat or dog presenting as an emergency (whether for suspected intoxication or for any other disease process) should have a major body systems assessment, to check for stability of the cardiovascular, respiratory and neurological systems. If derangements are present in any of these systems, immediate therapy should be instigated (eg. flow-by oxygen for any patients showing signs of respiratory distress) prior to full investigation. Many toxins can cause clinical signs, which require emergency management, eg. seizures secondary to metaldehyde intoxication, and, therefore, stabilisation of these signs are required.

Once the patient is stabilised, or if it presents in a stable state, it should be carefully assessed with a good history obtained from the owners and a thorough physical examination. It is important to ascertain the time since toxin exposure, the exact suspected toxin (dose and formulation, allowing calculation of whether a toxic dose has been reached), as well as any pre-existing disease and current medications. Often an exact toxin dose is unknown, in which case a maximum possible dose should be calculated or estimated, and therapy based upon this. Any clinical signs noted by the owner and any therapy they may have given should also be noted. It is also important to remember that the history of 'intoxication' may be a red herring, and without a proper investigation, the true cause of the animal's disease may not be detected.

DECONTAMINATION

Once intoxication has been diagnosed, the priority is to prevent the toxin damaging the patient, or at least minimise the effects the toxin has. If a patient has been exposed to a toxic dose of a product this is done by decreasing absorption of the toxin into the body alongside increasing its elimination. Toxins are generally orally ingested, so decontamination is usually focused on the gastrointestinal (GI) tract.

EMESIS

Inducing emesis is an effective method of decontamination if the toxin has been ingested very recently. Unfortunately, gastric emptying times and the efficiency of toxin absorption, means that there is often little point in inducing emesis if the toxin was ingested more than one to three hours previously, although this does depend on the toxin ingested, the rapidity of the formulation's absorption and the individual patient's gastric emptying time. Often owners are unsure exactly when exposure was (for example they return home after five hours to find a chewed paracetamol packet). In this situation, inducing emesis is justifiable, but the risks of the procedure should be explained to the owner. These risks are fairly minimal in a healthy dog or cat, but aspiration can occur. There are several drug options for inducing emesis. Apomorphine is probably the most commonly used drug, as it is effective and has minimal adverse effects. A dose of 0.04-0.1mg/kg should be administered subcutaneously. It is a fairly expensive drug and so other remedies are sometimes used such as 3% hydrogen peroxide (1-2ml/kg, take care not to administer stronger concentrations as this can result in marked oral ulceration) and washing soda crystals. These are effective emetics but require oral administration, which increases the risk of stress to the patient and potential aspiration, as well as the risk of the administrator being bitten! Other drug options include xylazine (0.6mg/kg/m) and the other alpha-2 adrenergic agonists drugs. These are more efficacious in cats than apomorphine, but do result in sedation. This tends to occur after emesis though, decreasing the risk of aspiration. Once emesis has occurred, then 'reversal' of the drug with atipamezole can be performed.

Inducing emesis is contraindicated if the patient has decreased mentation or is seizuring and is deemed unable to protect its airway (ie. does not have a gag reflex), which can be seen with toxins such as metaldehyde and recreational drugs. In these patients gastric lavage can be considered (see next page). Emesis should also not be performed if the toxin is corrosive, or a volatile agent, due to the risk of further damage to the oesophagus and aspiration respectively.

Owners may contact the veterinary practice from home

Figure 1: Lubricating the end of the stomach tube with sterile water based lubricant.

Figure 2: Measuring the stomach tube to the last rib of a dog.

if a toxin has just been ingested to enquire about administering an emetic themselves. In general, although they may have household agents such as hydrogen peroxide, which could induce emesis, this is not recommended. The risks of treatment failure and danger to both the client and animal are high and, therefore, the client should be advised to attend the practice as soon as possible. However, the vet should also be pragmatic, if distance or finance will decrease the likelihood of a rapid veterinary visit, and if the client is thought to be capable, then home administration of emetics may be the best option for the animal. It is worth noting that many owners are aware that salt water is an effective emetic and may attempt to use this method. This is to be strongly discouraged as it can result in marked hypernatraemia, especially if emesis does not result, causing severe neurological complications.

GASTRIC LAVAGE

If a dog or cat has ingested a toxin that has resulted in decreased mentation or seizuring (or it is suspected that this will occur shortly), then emesis cannot be induced due to the increased risk of aspiration. Gastric lavage can be performed in these patients if the toxin was ingested within the past one to three hours. This requires a full general anaesthetic, which may be required anyway in seizuring dogs and cats. A cuffed endotracheal tube is essential to decrease the risk of aspiration of lavage material into the lungs. The patient is placed in lateral recumbency with the head lower than the thorax. A large bore stomach tube is premeasured to the last rib; this ensures that the tube reaches the stomach. The tube is lubricated and gently introduced into the oesophagus and advanced into the stomach. The tube is then used to administer repeated boluses of 5-10ml/kg warmed fluid into the stomach. Ideally, a balanced electrolyte replacement fluid, such as Hartmann's or 0.9%NaCl, is used, as this will decrease the likelihood of electrolyte derangements post-lavage when compared to water administration. However, this can require a large volume of fluids, decreasing stock and increasing expense. The fluid should be administered via a funnel into the tube and then the tube lowered so the fluid flows out into a bucket. Several lavages are performed until the fluid obtained is clear and free from any evidence of food or toxin. Activated charcoal is then administered via the tube prior to the end of anaesthesia. The stomach tube can then be removed with the end of the tube occluded so that its contents are not lost from the tube on extraction. The endotracheal tube should be removed fairly 'late', so that the patient's gag has definitely returned and also the cuff should not be deflated prior to tube removal to decrease the risk of fluid above the cuff being aspirated.
Although gastric lavage may seem to be a more effective method of decontamination than inducing emesis, this is not necessarily so. The fluid administered in gastric lavage can propel stomach contents, including any toxin present, into the small intestine, and thereby increasing absorption. Gastric lavage is contraindicated, as with induction of emesis, if the toxin is corrosive.

ACTIVATED CHARCOAL

This is a carbonaceous compound with an extremely large surface area, it allows adsorbtion of many toxins. It is not effective for all toxins (eg. it is ineffective in cases of xylitol and ethylele glycol intoxication), so research of the potential toxin ingested is recommended. It is administered after emesis has concluded or can be given immediately if it is too long after toxin ingestion for emesis to be effective. Many indiscriminate dogs will eat activated charcoal mixed in with dog food, which does not decrease its efficacy at a clinically relevant level (Wilson and Humm, 2013). However, often it needs to be administered via a syringe, so great care should be taken to do this gently, to decrease the risk of aspiration and this should not be performed in any dog or cat with impaired ability to protect their airway. A naso-oesophageal tube can be used to administer activated charcoal if resistance to oral administration is marked; this can be a particularly useful technique in cats. A dose of 1-5g/kg is recommended.

Figure 3: A cat reacts after being dosed with activated charcoal.

Activated charcoal is available as a powder or as a slurry and some compounds have a cathartic included. This decreases gut transit time, thereby hopefully decreasing toxin absorption. Multiple doses of activated charcoal has been recommended if the toxin undergoes enterohepatic circulation (such as phenobarbital), with repeat dosing of 1-2g/kg every four to eight hours for up to 24 hours reported, although a product without a cathartic should be used to decrease the risk of dehydration. A recent study, looking at the use of multiple or single dose-activated charcoal in carprofen overdose, showed no benefit for repeated dosing of activated charcoal, but did report an increased incidence of (GI) side effects (Koenigshof et al, 2015).

CASE STUDY 1

A two-year-old Labrador presented with a history of weakness progressing to collapse that morning. He was tachycardic (160bpm) with bounding pulses and tachypnoeic (40bpm) with decreased heart and lung sounds. He was quiet but alert. A quick ultrasound examination showed pleural fluid was present and a diagnostic thoracocentesis obtained 4ml of non-clotting blood. The dog was given flow-by oxygen and a 20ml/kg bolus of Hartmann's over 15 minutes to attempt to stabilise it. The haemothorax could have been due to local disease (eg. neoplasia or trauma) or due to a systemic coagulopathy. Further discussion with the owner revealed that they had anticoagulant rodenticide on their property and with the acute onset of disease, the young age of the dog and with no history of trauma, toxin ingestion was strongly suspected to be the cause of the haemothorax. Blood samples were taken for prothrombin time and partial thromboplastin time and then vitamin K was administered, followed by 20ml/kg of fresh frozen plasma over the following five hours. The owners were asked to find out the exact type of rodenticide so that the length of time of vitamin K therapy was determined. The dog was discharged the next day with a minimal volume of pleural fluid and a complete resolution of the cardiovascular and respiratory clinical signs.

NON–GI TRACT DECONTAMINATION

Dermal absorption of a toxicant is probably best illustrated by the transdermal absorption of permethrin from 'spot-on', anti-flea preparations. Attempts for dermal decontamination can be made as soon as the product has been applied if it is realised a mistake has been made (for example administering a canine product to a cat). This involves clipping the affected area and bathing with dilute chlorhexidine (with gloves worn by the person decontaminating). Ocular decontamination is required if any irritant is present in the eye and involves copious flushing with tepid tap water or 0.9% NaCl for 20-30 minutes. Flushing should be performed from medial to lateral to prevent contamination of the other eye. The patient may need to be anaesthetised for this to be performed effectively, which also allows the eye to be examined thoroughly once decontamination has been performed.

ENHANCING TOXIN ELIMINATION

Once absorbed into the circulation, certain methods can be used to enhance the elimination of toxins. Intravenous fluid therapy is often used to enforce a diuresis, thereby, hopefully, increasing elimination of toxins, which are renally excreted. This also aids renal perfusion, thereby hopefully decreasing the likelihood of acute kidney injury. Intravenous lipid emulsion (ILE) therapy has recently attracted much veterinary attention as an effective method of enhancing the excretion of many toxins. The exact mechanism of action is unknown but the most popular theory is that administering an ILE creates a 'lipid sink' where fat soluble toxins are sequestered, 'trapping' them and thus preventing them from having adverse effects,

CASE STUDY 2

A six-year-old Jack Russell Terrier living with the Labrador described in case study 1, had been seen ingesting the anticoagulant rodenticide 30 minutes previously. Physical examination was unremarkable and emesis was induced with apomorphine. The dog vomited twice and produced material, which looked like the rodenticide. The dog was then sent home and the owners were instructed to keep him calm and to only take him out on short lead walks. He returned 48 hours later to have a blood sample to check his prothrombin time. This was found to be within normal limits and so no further treatment was required. This approach of inducing emesis and assessing whether a coagulopathy develops decreases unnecessary use of expensive vitamin K and has been shown to be effective (Pachtinger et al, 2008).

CASE STUDY 3

A two-year-old boxer dog was admitted in status epilepticus. Rectal diazepam was administered, followed shortly by intravenous diazepam, once an intravenous catheter was placed. This resulted in only a short resolution of the seizures, so a propofol continuous rate infusion (CRI) was started. A cuffed endotracheal tube was placed to decrease the risk of aspiration. Blood glucose was elevated consistent with the seizures, and calcium and sodium were within normal limits. The owner stated they had used slug pellets the day before and these were found to be metaldehyde. A presumptive diagnosis of intoxication was made and, given the patient's mental status, emesis could not be induced. Therefore, gastric lavage was performed, with activated charcoal administered at the end of the lavage process. The dog was also administered phenobarbitone intravenously. He was maintained on intravenous fluid therapy, and a pulse oximeter was used to monitor his oxygenation status (no supplemental oxygen was required). He was turned regularly and he had regular ocular and oral care to prevent corneal and oral ulceration respectively. Bladder size was monitored and his bladder was expressed when large. After 36 hours, he was successfully weaned off the propofol CRI and his mentation was appropriate.

CASE STUDY 4

A six-month-old kitten presented with acute onset tremors. She had been previously well and had had a non-veterinary prescription anti-flea spot-on administered that morning. She was alert but had marked muscular tremors and was unable to stand. She was tachycardic at 220bpm, but otherwise her cardiovascular and respiratory systems were deemed to be within normal limits. Intravenous diazepam was used to decrease the tremors. The anti-flea spot-on was found to contain permethrin and so she was given an intra-lipid emulsion bolus and started on a continuous rate infusion. The area where the spot-on was applied was also clipped and cleaned with dilute chlorhexidine. The tremors returned approximately 10 minutes after the diazepam was administered but were of decreased intensity and they resolved entirely after four hours.

and allowing them to be excreted. ILE therapy is useful for many toxins, including ivermectin, permethrin, naproxen, bupivacaine and many more. A bolus of 1.5-4ml/kg of a 20% ILE followed by a continuous rate infusion of 0.25ml/kg/min for 30-60 minutes is recommended, although higher rates may be required in some patients (Fernandez et al, 2011). Adverse effects of ILE therapy appear rare, although lipaemic plasma is often seen.

ANTIDOTES

If an antidote is available for a toxin, administration is key to management. Not all antidotes will be readily available within the practice and bigger local veterinary and human hospitals may need to be contacted to obtain the drug. Commonly utilised antidotes include misoprostol (a prostaglandin analogue) to decrease the GI effects of non-steroidal anti-inflammatory drug toxicity and ethyl alcohol as an antidote to ethylene glycol toxicity (which is effective through overloading the alcohol dehydrogenase enzyme, preventing conversion of the ethylene glycol to its toxic metabolite).

SUPPORTIVE CARE

Unfortunately, most toxins do not have an antidote and so in these cases, symptomatic supportive care is the optimal treatment available. Even if an antidote is available, supportive care is a vital part of management. As described above stabilisation of the major body systems is the initial aim.

Neurological effects of toxins are common and, so, careful assessment and monitoring of the neurological system is important. If a patient is markedly depressed, mentation and cranial nerve reflexes should be assessed regularly to assess for improvement or deterioration. Many recreational drugs, such as opioids, can cause marked depression, stupor or even coma. If a patient is seizuring, eg. secondary to metaldehyde toxicity, then diazepam should be administered. Often seizures are refractory and require continuous rate infusions of propofol or alfaxalone, while the toxin is metabolised. Cardiac arrhythmias are seen with drugs such as theobromine. Ventricular arrhythmias should be managed with lidocaine if the rate is above 160-180bpm. Supraventricular arrhythmias can be managed with diltiazem or beta-blockers.

Fluid therapy is often instigated in intoxicated patients

Libeo®, a new furosemide tablet from Interchem

Libeo® is a unique 4-way break, highly palatable tablet:

- Available in both a 40mg size and a unique 10mg size for smaller patients
- Each box contains 120 tablets in blister packs, removing the need to count out hundreds of small tablets
- The 4-way break tablets allow accurate dosing and adjustment of the furosemide dose as necessary.

Talk to your Territory Manager for more information.

interchem

Interchem (Ireland) Ltd, Unit 29, Cookstown Industrial Estate, Dublin 24
Tel: 01 451 2959 Email: info@interchem.ie Web: www.interchem.ie

to aid drug excretion (if it is renally excreted) and to prevent dehydration. Inducing a diuresis may also offer some protection if the toxin causes acute kidney injury, eg. ingestion of grapes in dogs and lilies in cats. S-adenosyl-methionine (SAMe) can be administered to patients that have ingested a hepatotoxin such as xylitol and gastroprotectants, such as omeprazole or ranitidine, can be administered to those with gastrointestinal toxic effects. Once emesis has successfully been performed, if the patient is nauseous or continues to vomit, antiemetics, such as maropitant, may also be required.

CONCLUSION

Rapid assessment and decontamination of intoxicated patients is important to maximise the chances of a successful outcome.

Once a patient is symptomatic, then basic supportive care is vital. The general practitioner cannot be expected to know all the possible toxic agents that may affect dogs and cats, let alone the appropriate treatment, including antidotes, for each.

The veterinary poisons information service (VPIS) can offer support to veterinary surgeons by providing up-to-date advice about whether a product is toxic to dogs and cats, if so at what dose and also about optimum management (www.vpisglobal.com). The Poisons Information Centre of Ireland (www.poisons.ie) is also an important free source of information that veterinary surgeons can contact. Both services are available 24 hours a day, 365 days a year.

REFERENCES

1. Fernandez, AL, Lee JA, Rahilly L et al. The use of intravenous lipid emulsion as an antidote in veterinary toxicology. Journal of Veterinary Emergency and Critical Care 2011; 21(4): 309-320
2. Koenigshof AM, Beal MW, Poppenga RH, Jutkowitz LA. Effect of sorbitol, single and multidose activated charcoal administration on carprofen absorption following experimental overdose in dogs. Journal of Veterinary Emergency and Critical Care 2015; 25(5): 606-610
3. Lee JA. Approach to drug overdose. Small Animal Critical Care Medicine (2nd Ed) 2015; 74: 385-389. Eds: DC Silverstein and K Hopper
4. Pachtinger GE, Otto CM, Syring RS. Incidence of prolonged prothrombin time in dogs following gastronintestinal decontamination for acute anticoagulant rodenticide ingestion. Journal of Veterinary Emergency and Critical Care 2008; 18(3): 285-291
5. Wilson HE, Humm K. In vitro study of the effect of dog food on the adsorptive capacity of activated charcoal. Journal of Veterinary Emergency and Critical Care 2013; 23(3): 263-267

Reader Questions and Answers

WHICH OF THE FOLLOWING DOGS SHOULD NOT HAVE EMESIS INDUCED?

A: A four-year-old Boxer, who has eaten 40 500mg paracetamol tablets at some point over the last six hours.
B: An eight-year-old Golden Retriever with laryngeal paralysis, who has eaten two 200g bars of 80% dark chocolate in the last 30 minutes
C: A seven-year-old vicious cat which was seen licking lily pollen off its coat an hour ago
D: A seven-year-old Bedlington Terrier with copper toxicosis, who has just eaten three mince pies

WHICH OF THE FOLLOWING TOXINS CAN CAUSE SEIZURES?

A: Metaldehyde
B: Ivermectin
C: Methylxanthines
D: Tremorgenic mycotoxins

GASTRIC LAVAGE REQUIRES WHAT VOLUME OF FLUID TO BE ADMINISTERED?

A: 5-10ml/kg in repeated boluses
B: 10-20ml/kg in repeated boluses
C: 20-40ml/kg in repeated boluses
D: 50ml/kg in reated boluses

INTRAVENOUS LIPID EMULSION THERAPY IS:

A: Useful in the management of lipid insoluble toxins
B: Useful in the management of lipid soluble toxins
C: Useful in the management of all toxins
D: Useful in the management of toxins which are renally excreted

WHICH OF THE FOLLOWING SHOULD NOT BE USED AS AN EMETIC?

A: 3% hydrogen peroxide
B: Xylazine in cats
C: Salt water in dogs
D: Washing soda crystals

ANSWERS: 1: B THE DOG IS UNCABLE TO EFFECTIVELY PROTECT ITS AIRWAY AND IS AT INCREASED RISK OF ASPIRATION, GASTRIC LAVAGE SHOULD BE PERFORMED, 2: ALL OF THEM, 3: A, 4: B, 5: C SALT WATER SHOULD NOT BE USED AS AN EMETIC IN ANY ANIMAL