When should a case be transferred to a critical care service?

Adam Lancaster DVM, DACVECC
BluePearl in Michigan

THE SIMPLEST ANSWER to this question is that a criticalist is best brought onto a case when a patient has a life-threatening condition and/or requires 24-hour care. Examples would include patients who require blood transfusions, patients in shock, polytrauma, cases of respiratory distress, diabetic ketoacidosis or hepatic lipidosis. These are complex cases that may require hour-to-hour or minute-to-minute changes in therapy, and these are the cases that DACVECCs dream of at night! Criticalists are also trained extensively in the treatment of life-threatening emergencies that may require immediate treatment such as placement of an emergency tracheostomy tube, pericardiocentesis or pleurocentesis.

DACVECCs are trained intensively in the pathophysiology of body systems and the complex interactions that may occur with multiple disease processes. Therefore, patients with numerous co-morbidities that require anesthesia for a surgical procedure may benefit from the surgery being performed in a hospital with a DACVECC. We may also serve as a first stop for a patient that needs urgent referral to another service. We work closely with the other specialists in the hospital if an urgent or same-day referral is required.

It is always important to weigh the risk of delayed treatment for these life-threatening conditions when considering a transfer. Here in Walthan, Kristina DePaula, DVM, DACVECC, welcomes your calls to talk through a case and help weigh the options for your patient.

Chocolate Toxicity

CHOCOLATE TOXICITY IS ONE of the most commonly encountered poisonings in dogs. Chocolate is readily available, particularly during the holidays, and dogs (much like people) tend to find it irresistible.

Clinical signs

Gastrointestinal, cardiac and neurological symptoms predominate. Mild symptoms include vomiting, restlessness, hyperactivity and polyuria. Moderate symptoms include tachycardia, arrhythmias, weakness, ataxia, diaphoresis and muscle tremors. With severe intoxications, seizures and coma are possible. Hyperthermia, hypertension and hypokalemia can also develop. Pancreatitis is a possible sequela due to the high fat content in chocolate. The highest concentration of theobromine is found in cocoa, dark chocolate and baking chocolate, and the lowest in white and milk chocolates. As little as ¼ cups of semi-sweet chocolate chips is toxic to a 10 kg dog.

Mechanism of toxicity

Theobromine and caffeine belong to the methylated xanthine alkaloid family (methylxanthines), and they are the primary toxic principles in chocolate. Excessive ingestion of chocolate-containing products results in stimulation of the central nervous system, heart and skeletal muscle and cause smooth muscle relaxation. Methylxanthines inhibit the breakdown of cyclic AMP and antagonize adenosine receptors, resulting in alterations to neurotransmitter and hormone-mediated actions. The consequences include excessive stimulation of the cerebral cortex and myocardium (theobromine), and medulla, respiratory center and skeletal muscles (caffeine). These toxins also cause diuresis and increase the release of catecholamines, particularly norepinephrine. The half-life of elimination of theobromine (at 17.5 hours) is long in the dog, so symptoms can be prolonged.

Theobromine and caffeine content in chocolate products (mg/oz)

Note: 1 oz = 28.4 grams

<table>
<thead>
<tr>
<th>TYPE</th>
<th>THEOBROMINE</th>
<th>CAFFEINE</th>
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<tbody>
<tr>
<td>White</td>
<td>0.25</td>
<td>0.85</td>
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<tr>
<td>Milk</td>
<td>44-60</td>
<td>6</td>
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<tr>
<td>Semisweet</td>
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<td>22</td>
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<td>Unsweetened baking</td>
<td>390-450</td>
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<td>Cocoa powder</td>
<td>400-737</td>
<td>30-50</td>
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<tr>
<td>Cocoa bean mulch</td>
<td>56-900</td>
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</table>

Toxic doses

| Mild signs (vomiting, hyperactivity) | 20 mg/kg theobromine |
| Cardiac toxicity                   | 40 mg/kg theobromine |
| Seizures                           | 60 mg/kg theobromine |
| LD50 theobromine                   | 250-500 mg/kg (dogs), 200 mg/kg (cats) theobromine |
| LD50 caffeine                      | 140-150 mg/kg (dogs), 100-150 mg/kg (cats) theobromine |

Treatment

1) Induce vomiting, if vomiting has not yet occurred, with apomorphine 0.04 mg/kg IV/IM/subconjunctival (or 3% hydrogen peroxide 1 ml/lb if apomorphine is not available).
2) Give activated charcoal (1-3 g/kg), repeated every 4-6 hours for a total of 2-3 doses due to enterohepatic recirculation. The first dose can contain sorbitol.
3) Severe tachycardia can be treated with propranolol at 0.02-0.06 mg/kg IV slowly.
4) Hospitalize for monitoring, IV fluids, encourage frequent urination.

NOTE: Inducing emesis and oral administration of activated charcoal is contraindicated if the patient is mentally dull, unconscious, or having seizures, due to the risk of aspiration. Gastric lavage is recommended in these patients.

At BluePearl Veterinary Partners, our critical care service can provide emergency and around-the-clock intensive care of pets with chocolate toxicity. Therapy and monitoring can include gastrointestinal decontamination, gastric lavage, IV fluid therapy, continuous ECG monitoring, treatment of severe tachycardias, and seizure management. As methylxanthines can be reabsorbed across the bladder wall, for severe intoxications, urinary catheter placement can also be performed.

For support of the pet with chocolate toxicity or other poisonings, please contact our critical care service.
A Tufts undergraduate and St. George’s DVM, Dr. Carney completed her internal medicine residency at the University of Minnesota. She is happy to be back in Boston, where we had a milder winter than Minnesota had this year, if you can believe it. Dr. Carney loves all aspects of internal medicine and has a special interest in abdominal ultrasonography, chronic kidney disease and endoscopic procedures, in particular GI scoping.

Get to know Dr. Carney:

Outside of veterinary medicine, what do you consider yourself to be an expert at?
I’m an expert at remembering lots of silly details about pop culture. I’m moderately good at running, and I’m a total mess at most things that have to do with cooking and baking!

What was your first job?
I think my very first job was walking my neighbor’s two dogs when he was away. I believe I was paid $10 a visit, usually going over twice a day. I learned a lot about dealing with dogs (we didn’t have any pets), especially their personalities and quirks.

What’s on the horizon in internal medicine that most excites you?
I think the things that are being learned with minimal invasive surgery and interventional radiology are going to change the way we treat a lot of conditions.

Was there a teacher who changed your life?
There was an internal medicine clinician during my clinical year who I admired because he was smart but also very funny and down to earth. It was encouraging to see those characteristics in someone in such a stressful position.

What is the most interesting trip you have taken?
My most interesting trip was the three years I spent living in Grenada. For the future, any trip would be fascinating to explore.

Dr. Maura Carney
Internal Medicine Service

A T "...Meet our specialists...

Chronic Vomiting and Diarrhea in the Dog: A Stepwise Approach to Diagnosis and Treatment

Lisa Lange, DVM, DACVIM
BluePearl in Georgia

Chronic signs occurring > 10-14 days
History
Signs intermittent? Persistent?
Appetite?
Change in weight?
Environment? Exposure risk (dog parks, doggy day care, boarding etc.)
Travel history?
Diet? Change in diet?
Signs correlate to stressful events?
Diarrhea
» Appearance (focal charts are helpful for owners to assess consistency)
» Frequency
» Blood/mucus
» Melena
» Icterus/urgency
Vomiting
» Appearance - food (digested/undigested), bile, blood
» Time relation to eating
» “Active” process/passive (rule out vomiting vs. regurgitation)

Physical examination
Assess for weight loss, muscle loss Pain on abdominal palpation Borborygmus Rectal examination

What next?
Is patient clinically stable besides intermittent vomiting and diarrhea? More conservative approach reasonable
Is patient systemically ill? Losing significant weight? More aggressive approach recommended

Clinically stable
Fecal exam, prophylactic deworming even if fecal negative Food trial with novel protein/carbohydrate diet, hypoallergenic diet
(Dismiss strict to diet - no flavored heartworm preventive, drugs, flavored chews/toys, litter box “treats” etc.)
Symptomatic medications - metronidazole, Pepcid,® anti-anaeas... NOT steroids!

Systemically ill (or persistent signs despite food trial, symptomatic medications)
CBC, biochemistry (with electrolytes), UA Fecal examination Abdominal imaging (radiographs, barium study, ultrasound)
GI testing - CPT, TLI, cobalamin, folate Endoscopic or surgical biopsies

Differential diagnoses (not a complete list - more common considerations)
Food intolerance Infection (parasites, fungal, protozoal, mycobacterial) Small intestinal bacterial overgrowth Antibiotic responsive diarrhea Chronic pancreatitis Exocrine pancreatic insufficiency Inflammatory bowel disease Lymphangiectasia Lymphoma Hypocortisolemia Signalement, breed and history can help narrow down the likely differentials (older patient gastrointestinal lymphoma more likely than a young patient, hypocortisolemia in predisposed breeds)

Gastrointestinal biopsies
Endoscopy
Advantages - minimally invasive; visualization and biopsy of focal lesions; multiple biopsies; minimal risks; if steroids/chemotherapy needed for treatment, no delay in treatment
Disadvantages - general anesthesia; risk of perforation (small); limited evaluation (duodenum in most patients, jejunum in small dogs/cats); small and superficial biopsies may miss diseases like lymphoma, lymphangiectasia that require deeper biopsies; cost and maintenance of equipment; expertise

Surgery
Advantages - multiple biopsy sites; large and full thickness biopsies; assessment and biopsies of other organs; corrective surgery if indicated
Disadvantages - general anesthesia; post surgical dehiscence; recovery time – have to wait at least 10-14 days for steroids/chemotherapy if needed for treatment

What if owner declines biopsies, other testing is unremarkable and symptomatic treatment not working?
Empirical therapy with prednisone is commonly used. It is important that the owner be aware that depending on the underlying disease, signs could get worse (i.e. histoplasmosis) on steroids. Also, if lymphoma is the underlying cause and is later confirmed and chemotherapy elected, previous prednisone treatment will cause resistance to chemotherapy drugs and may affect response. Make sure owners are informed how steroids can affect the patient, future testing and treatment.
Fever vs. Hyperthermia

ANIMAL'S BODY TEMPERATURE is regulated by the thermoregulatory center in the anterior hypothalamus (AH). It acts like a thermostat to maintain temperature as close to normal (“set point”) as possible and sets off activities in the body to dissipate or conserve heat. True fever is a term used for those hyperthermic animals where the set point of the AH has been reset to a higher temperature. This is a normal response of the body to injury or pathogens and is also part of the acute phase response.

Hyperthermia is the term used to describe any elevation in core body temperature and is a result of equilibrium loss in the thermoregulatory center, but the “set point” of the AH has not changed. The body raises the temperature as a response to physiologic, pathologic or pharmacologic causes when the heat gain exceeds the heat loss.

A good history and physical exam are the most crucial in differentiating fever from hyperthermia. Hyperthermia can be caused by increased muscle activity such as seizures, exercise or nervousness. Heat stroke may result from being left in a car on a warm day or confined to an area with no water or shelter on a hot day. Fever can be induced by drugs, immune-mediated disease, neoplasia, infection or inflammatory disorders.

Initial diagnostics should include a detailed history (travel history, vaccination status, pet environment, response to previous medications, parasite control, sickness in other household pets, previous injury, etc.), physical exam, complete blood work, cultures (UA, etc.), physical exam, complete blood work, cultures (UA, etc.), and chest +/- abdominal radiographs.

When should a methimazole trial be performed?

There is no straightforward answer to this question. Most cats with hyperthyroidism don’t need a methimazole trial. After all, you still have to treat the hyperthyroid condition. Nevertheless, we will consider performing a methimazole trial in cats greater than 15 years of age and in those cats with any suspicion for concurrent kidney disease based on the patient’s history, exam findings, and lab test results (significantly elevated BUN value and isosthenuria).

What is the best treatment for hyperthyroidism?

Overwhelming opinion is that radioactive iodine therapy is the best treatment. Curing the condition by this method does not risk the parathyroid glands, which may occur during surgical removal of the thyroid glands. On the other hand, poor client compliance and inadequate methimazole dosing can allow the hyperthyroid condition to slowly damage the heart and even the kidneys when medical management is pursued.

The risk for side effects from the methimazole and the additive expense of the medication and subsequent thyroid monitoring are additional reasons to consider curing the condition with a single dose of radioactive iodine. In a recent JAVMA study, hyperthyroid cats treated with radioactive iodine were shown to live longer than those treated with methimazole despite the iodine-treated population actually being older in age.

When is Feline Hyperthyroidism and Kidney Failure a Concern?

IT IS WELL DOCUMENTED that increases in renal blood flow and glomerular filtration rate secondary to hyperthyroidism can mask renal insufficiency. In reverse, correction of the hyperthyroid condition thereby normalizing the hypermetabolic state may allow a concurrent kidney insufficiency to become apparent. Even though the hyperthyroid treatment is not the cause, azotemia may become evident.

The good news is that, despite the development of post treatment azotemia, most cats will do fine. In one study, the median survival time in cats treated for hyperthyroidism that developed azotemia was similar to treated cats that did not develop azotemia (>500 days).

It is the correction of the hyperthyroid state and not the type of treatment that unmasks the azotemia. Therefore, it is possible to get a preview of the cat’s true kidney function, prior to curing the condition with radioactive iodine, by performing what has been termed a methimazole trial. To perform a trial, administer methimazole with the goal of dropping thyroid hormone levels into the normal range. Once thyroid levels have normalized, then blood tests performed 2 to 4 weeks later would be expected to demonstrate the BUN and creatinine values that you would see after radioactive iodine therapy.

When should a methimazole trial be performed?

It is a good idea to recommend that owners of purebred cats have their cat’s blood typed for future consideration. Should a transfusion ever be required. Knowing the blood types of the donor and recipient cats and/or crossmatching the blood samples prior to administering a transfusion will decrease the chance of inducing a serious transfusion reaction.

TO TREAT HYPERTHERMIA, IT IS NECESSARY TO ELIMINATE THE CAUSE OF HEAT STRESS, AND IN THIS CASE COOLING METHODS WORK.

In true fever, the high temperature is being regulated by the body. Body cooling methods, such as water baths, are not recommended because they work against the body’s own regulatory mechanism, which is trying to meet the temperature set by the AH. Glucocorticoids should be reserved for treating fever known to be of a non-infectious cause. Most indications for glucocorticoids include immune-mediated diseases.

To treat hyperthermia, it is necessary to eliminate the cause of heat stress, and in this case cooling methods work. To avoid hyperthermia, cooling procedures should be stopped when the temperature has been decreased to 103-103.5°F. Avoid precipitous drop in temperature. Ice baths are not recommended because shivering and vasoconstriction lessen heat loss.

Fever may inhibit bacterial and viral proliferation, and leukocyte mobility and phagocytosis may be enhanced by fever. Most studies have shown that a fever will reduce the duration of many infectious diseases. Prolonged fever of >106°F may result in brain damage, heat stroke or DIC. It can also increase metabolic state and oxygen consumption, raising calorics and water requirements.

Fever of unknown origin, FUO, is defined as a fever three weeks in duration in the face of aggressive diagnostic testing and lack of any explanatory history or physical finding. Evaluating for infectious and immune-mediated disease, tissue trauma and neoplasia can help in diagnosing a fever where no obvious cause exists.

What Blood Type Does Your Cat Have?

Most cats in North America have type A blood. Pure breeds, such as Birman, Persians, Abyssinians, exotic and British shorthairs, and Cornish and Devon rexes can have type B blood. The propensity for these breeds to have type B blood probably varies with the specific breeding colonies present in a particular geographic area.

It is a good idea to recommend that owners of purebred cats have their cat’s blood typed for future consideration, should a transfusion ever be required. Knowing the blood types of the donor and recipient cats and/or crossmatching the blood samples prior to administering a transfusion will decrease the chance of inducing a serious transfusion reaction.
THE PRESENCE OF AN ELEVATED WHITE BLOOD CELL (WBC) count in a patient with clinical signs and laboratory findings typical of immune mediated hemolytic anemia (IMHA) can throw you off the diagnosis. Could the high WBC count indicate there is another cause for the anemia?

Possibly, but it is actually not uncommon to have a high WBC count in dogs with IMHA. White blood cells are a component of the immune system, so excessive stimulation of the immune system by pro-inflammatory mediators released during the disease process could obviously contribute to the excessive production and circulation of WBCs.

Numerous reasons exist for an elevated WBC count in dogs with IMHA. Increased concentrations of pro-inflammatory cytokines released in response to circulating immune complexes and tissue injury stimulate WBC production. Treatment with corticosteroids will cause demargination of neutrophils from the vascular walls into the circulating blood as well as stimulate their production in the bone marrow. General bone marrow stimulation secondary to increased concentrations of erythropoietin and other pro-blood cell production mediators caused by the patient’s anemia may also play a role.

A study published in the Journal of the American Veterinary Medical Association in 2001 tried to evaluate the significance of elevated WBC counts in dogs with IMHA. Thirty-four dogs diagnosed with IMHA were grouped based on the severity of their leukocytosis. The study concluded that dogs with higher WBC counts demonstrated the most severe tissue injury. In these dogs, ischemic necrosis of the liver, kidney, heart, lung, and spleen was found and attributed to hypoxia associated with the patient’s anemia and to the presence of thromboembolic disease.

You cannot entirely exclude the possibility that infection is contributing to the anemia or that the patient has developed an infection secondary to being immunosuppressed. A thorough evaluation of the patient is in order to rule out an underlying or concurrent disease. If infection is not identified, then treatment objectives should focus on improving blood oxygen-carrying capacity and monitoring for thromboembolic disease.