Medical emergencies in canine and feline cancer patients may be related to the cancer itself or to treatment prescribed for the cancer. Veterinarians treating cancer patients must have a general understanding of common oncologic emergencies and what tumor types are more likely to be associated with emergent conditions. Moreover, they must be able to recognize the clinical signs associated with oncologic emergencies and must effectively communicate with pet owners to assure that such emergencies are treated promptly and appropriately.

**Tumor-related emergencies**

**Cancer progression/organ failure**

The eventual lethality of most cancers is related to their destruction and replacement of normal functional tissues, ultimately culminating in organ failure. Most cancers, particularly solid tumors (carcinomas and sarcomas), are characterized by slow and insidious progression. Some cancers, however, are characterized by much more rapid rates of cellular proliferation, and consequently more rapid rates of clinical progression. With few exceptions, these tumors are usually hematopoietic in nature, and include lymphomas, leukemias (particularly acute lymphoid leukemia and acute myeloid leukemia), and histiocytic sarcoma/malignant histiocytosis. Dogs and cats diagnosed with these tumors must be monitored carefully for signs related to cancer progression, which may worsen suddenly over a period of days rather than weeks to months, as is more typical of solid tumors.

**Cardiovascular**

Hypovolemia and shock secondary to tumor-associated hemorrhage is probably the most important cardiovascular emergency in veterinary cancer patients. Hemorrhage may be outwardly evident to the pet owner, but is often occult. The most common sites of occult hemorrhage in dogs and cats with cancer are the abdominal cavity and the gastrointestinal tract. Intra-abdominal hemorrhage may be associated with tumors of highly vascular organs such as the liver and spleen. Bleeding tumors of the gastrointestinal tract are often associated with melena or hematochezia. Gastrointestinal hemorrhage is usually chronic and insidious, but acute, severe bleeding may occur on occasion.

Hemangiosarcoma is by far the most likely tumor to cause acute, life-threatening hemorrhage in dogs. Common sites for hemangiosarcoma include the spleen, liver, and right atrium. Hemoabdomen associated with abdominal hemangiosarcoma produces abdominal distension, weakness, collapse, mucosal pallor, tachycardia, and tachypnea. Cardiac hemangiosarcoma may bleed into the pericardial sac, producing life-threatening pericardial effusion. Dogs with cardiac hemangiosarcoma and pericardial effusion may show exercise intolerance, mucosal pallor, weak femoral pulses, collapse, and possibly sudden death. Owners of dogs with hemangiosarcoma should be instructed to monitor their dogs for clinical signs of hemorrhage at home. Initial clinical signs of hemorrhage may be vague and non-specific, such as decreased appetite or energy level. These vague signs may in fact be the earliest indicators of potentially serious tumor-related hemorrhage. Aggressive intravenous (IV) fluid therapy and/or blood component therapy are indicated for patients showing signs of hypovolemic shock secondary to hemorrhage. Surgical correction of hemorrhage is often the definitive therapy, but must be considered carefully. Patients with hemodynamic compromise or with multiple sites of tumor-associated bleeding may not be ideal candidates for surgery.

Thromboembolic disease may also occur in patients with cancer; indeed thrombosis is the second leading proximate cause of death in human cancer patients. The coagulation system is frequently altered in cancer patients, producing a hypercoagulable state. Thromboembolic disease is usually characterized by peracute onset of clinical signs. These may include severe dyspnea and tachypnea in patients with pulmonary thromboemboli; seizures, ataxia, blindness, and coma in patients with thromboemboli of the CNS; acute paresis, peripheral hypothermia, and pain in patients with arterial thromboemboli of the distal extremities; and rapidly progressive subcutaneous edema in patients with peripheral venous thromboemboli. While potentially any tumor may be associated with thromboembolic disease, hemangiosarcoma, thyroid carcinoma, inflammatory mammary carcinoma, carcinoma of the lung, and lymphomas are well-documented to produce alterations in hemostasis. Patients with these tumors may be at higher risk for thromboembolic disease.

**Respiratory**

Respiratory emergencies may occur in patients with a variety of intra-thoracic cancers. The lungs have tremendous functional reserve, and a large amount of lung capacity must be lost before severe clinical signs develop. Therefore, patients with solitary lung tumors rarely become emergently dyspneic unless the tumors are extremely large. Likewise, patients with metastatic lung cancer usually do not show emergent respiratory signs until the tumor nodules have obliterated a large portion of the functional pulmonary parenchyma. In contrast, malignant pleural effusion can rapidly diminish functional lung capacity and lead to life-threatening respiratory compromise. Lymphoma is the most common tumor to produce pleural effusion in dogs and cats. However, pleural effusion can result from virtually any intrathoracic cancer. In addition to dyspnea and tachypnea, dogs and cats with pleural effusion may show...
vague signs such as reduced appetite (especially cats) and lethargy. Orthopnea (difficulty breathing in a prone position) may also be observed in animals with pleural effusion. Thoracocentesis is the treatment of choice for emergent management of malignant pleural effusion. Intrathoracic chemotherapy or chemical pleurodesis may also be used in selected cases.

**Hematologic**

Hematologic emergencies include neutropenia and thrombocytopenia. Clinically significant neutropenia and thrombocytopenia more often result from cancer treatment than the cancer itself. However, some cancers, particularly lymphoma, leukemias, and histiocytic sarcoma commonly infiltrate the bone marrow, resulting in decreased production of platelets, neutrophils, and other blood cells. Thrombocytopenia in cancer patients may also result from immune-mediated destruction or disseminated intravascular coagulation (DIC).

As the most common cause of neutropenia in veterinary cancer patients is myelosuppressive chemotherapy, the management of neutropenia will be discussed in detail under “Treatment-Related Emergencies” below. Thrombocytopenic patients are at increased risk for hemorrhage. The classic clinical signs of thrombocytopenia are petechial and ecchymotic hemorrhages, which may occur on the skin, sclera, or mucous membranes. Thrombocytopenia may also exacerbate co-existing coagulopathies. Therapy for tumor-related thrombocytopenia should be directed at the underlying cancer.

**Renal**

Paraneoplastic hypercalcemia may cause renal failure in affected dogs and cats. Tumors commonly associated with hypercalcemia include lymphoma and anal sac adenocarcinoma in dogs and squamous cell carcinoma in cats. The most common clinical signs of hypercalcemia are polyuria and polydipsia. The best treatment for hypercalcemia is to treat the underlying tumor, and in some cases this is the only treatment that is necessary. However, azotemic hypercalcemic patients should be treated with aggressive IV fluid therapy. Furosemide, glucocorticoids, and intravenous aminobisphosphonates may also be helpful.

**Neurologic**

The clinical signs of CNS tumors may include seizures, altered mentation, head tilt, circling, ataxia, anisocoria, and coma. Veterinarians and pet owners should always be cognizant of the neurologic status of patients with primary CNS tumors. In addition, some tumors, including lymphoma, hemangiosarcoma, histiocytic sarcoma, and malignant melanoma have a high rate of metastasis to the CNS. Thus, any neurologic signs in patients with these tumors should be cause for concern. Treatment of neurologic complications of cancer should be directed at the underlying tumor whenever possible. Anti-epileptic therapy (e.g. diazepam 0.5 mg/kg IV or 1.0 mg/kg per rectum) should be administered for seizures. Intravenous mannitol and glucocorticoids should be administered if increased intracranial pressure is suspected.

**Orthopedic**

Patients with osteosarcoma and other bone tumors may develop pathologic fracture at their tumor site. For appendicular tumors, pathologic fracture usually manifests as an acute, severe non-weight-bearing lameness of the affected leg. Pathologic fracture of the appendicular skeleton may be treated with IV fluid therapy. Surgical stabilization of the fracture site may be possible in some cases. Amputation may be necessary to treat pathologic fractures of the appendicular skeleton. Radiation or chemotherapy directed at the primary tumor may help to facilitate fracture healing in certain cases.

**Treatment-related emergencies**

**Chemotherapy**

The organ systems at greatest risk for injury following chemotherapy are the gastrointestinal and hematopoietic systems. Gastrointestinal signs of chemotherapy toxicity include ptyalism, decreased appetite, vomiting, and diarrhea. Chemotherapy-induced gastrointestinal signs may be either acute or delayed in nature. Acute nausea and vomiting is caused by stimulation of the chemoreceptor trigger zone, and occurs within 24 hours of chemotherapy administration. Cisplatin is by far the most common cause of acute chemotherapy-induced nausea and vomiting. Acute nausea and vomiting can often be ameliorated or prevented with anti-emetic drugs such as maropitant (Cerenia™). Delayed nausea, vomiting, and diarrhea are caused by death of intestinal epithelial cells. This may occur following treatment with many chemotherapy drugs, and usually manifests 3-5 days following drug administration.

When assessing patients with gastrointestinal toxicoses from chemotherapy, it is important to consider the severity of the clinical signs. Mild diarrhea or vomiting (≤3 episodes per day) and mild inappetance occur relatively commonly, and may be managed with dietary modification and oral anti-emetic or anti-diarrheal medications. Patients with severe vomiting or diarrhea (>3 episodes per day) and complete anorexia or adipsia should be examined by a veterinarian, and may need to be hospitalized. Patients exhibiting signs of dehydration (sunken eyes, tacky mucous membranes) or that are unable to maintain enteral hydration should be hospitalized and treated with IV fluid therapy.

The most important hematologic side effect of chemotherapy treatment is neutropenia. For most drugs, the low point in the segmented neutrophil count (nadir point) occurs 7-10 days following chemotherapy administration. Neutropenia may be a side effect of virtually any chemotherapy drug, but doxorubicin, carboplatin, and lomustine (CCNU) may cause particularly severe neutropenia. A complete blood count should be performed at the time of expected neutrophil nadir in all patients receiving myelosuppressive
chemotherapy to make sure that the segmented neutrophil count is acceptable. Patients with neutrophil counts of <1,000 cells/μl at the nadir point should be treated with prophylactic oral antibiotic therapy.

Neutropenic dogs and cats are at increased risk for bacterial sepsis. The initial clinical signs of neutropenia can be quite vague – lethargy is often the first problem that pet owners will notice. Owners can be shown how to take a rectal temperature on their pet at home in order to monitor for fever. A rectal temperature of ≥ 103°F should prompt the owner to seek immediate veterinary attention. Febrile neutropenic patients should be managed with broad-spectrum antibiotic therapy and barrier nursing in a hospitalized setting.

Extravasation injury is another important side effect of chemotherapy treatment, but fortunately it is 100% preventable with careful drug administration technique. Drugs that produce extravasation injury include doxorubicin, vincristine, and vinblastine. These drugs are referred to as vesicants; all vesicants should be given through a perfectly placed IV catheter. Patients should be appropriately restrained during administration of vesicant drugs to prevent catheter dislodgement. Chemical restraint should be seriously considered in fractious patients.

If a chemotherapy extravasation is suspected, drug administration should be stopped immediately and an attempt should be made to aspirate extravasated drug back into the IV catheter. Local heating or cooling of the site of extravasation may be helpful. Topical or injectable antidotal therapies may also help to prevent tissue injury. In severe cases, surgical debridement of the extravasation site or even amputation may be necessary.

Other therapies
Non-steroidal anti-inflammatory drugs (NSAIDs) are frequently administered to veterinary cancer patients to treat tumor-related pain and inflammation. In addition, NSAIDs can be given as a primary treatment for certain cancer types (e.g. transitional cell carcinoma of the urinary bladder in dogs). Although most veterinary patients tolerate NSAIDs very well, renal and gastrointestinal toxicoses may occur in some cases. In particular, gastrointestinal injury from NSAIDs may be severe and potentially life-threatening. NSAIDs may cause gastrointestinal bleeding and ulceration, and in severe cases, perforation of the gastrointestinal tract. Clinical signs of NSAID-induced gastrointestinal injury include inappetance, vomiting, hematemesis, melena, and hematochezia. Owners should be instructed to stop NSAID therapy immediately in dogs or cats that develop gastrointestinal signs while on these medications. NSAID therapy should not be re-instituted until gastrointestinal signs resolve. In some cases, administration of antacids (e.g. famotidine, ranitidine, omeprazole) and gastroprotectants (e.g. sucralfate, misoprostol) may be warranted.

References