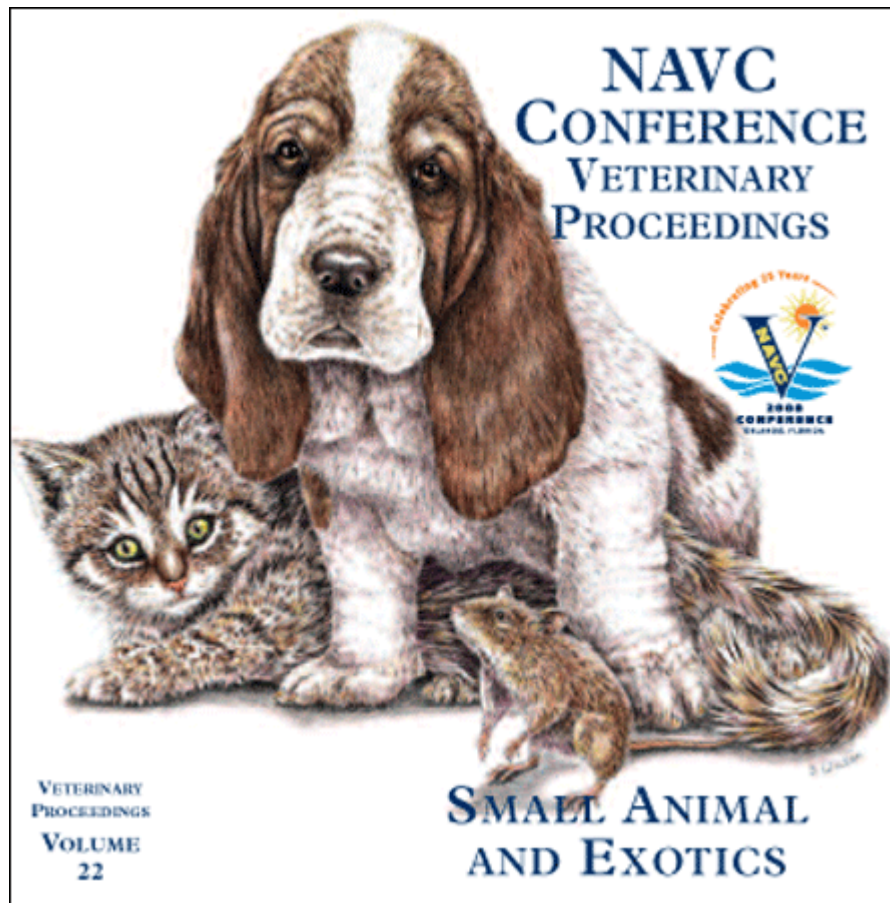


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## TUMORS OF THE SPLEEN AND LIVER: YOUR QUESTIONS ANSWERED

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### HEPATOBIILIARY CANCER IN DOGS AND CATS

The most common primary hepatic tumors in dogs are hepatocellular adenoma and hepatocellular adenocarcinoma. The most common malignant hepatic cancers of cats are hepatocellular carcinoma and cholangiocarcinoma. Most animals with hepatobiliary neoplasia are older than 10 years. Clinical signs are often nonspecific but include the presence of an abdominal mass, weight loss, vomiting, ascites, and occasionally icterus. Icterus is relatively uncommon sign in dogs unless there is obstruction of the biliary outflow tract. In cats however, icterus is a common presenting clinical sign associated with hepatic tumors.

Initial workup should include blood work (including clotting profiles), urinalysis, and three-view thoracic radiographs, and an abdominal ultrasound should be performed. Fine-needle aspiration (FNA) of the mass can safely be performed using ultrasound guidance and may help the clinician determine the disease process. Advanced imaging such as CT scan or MRI can be helpful for extremely large tumors or those in deep-chest breeds to help determine the likelihood of successful excision. Serum alanine aminotransferase (ALT) and alkaline phosphatase (ALP) are often elevated in dogs and cats with hepatic tumors.

Early and aggressive excision is the treatment of choice for most hepatobiliary masses. The presence of diffuse involvement in multiple liver lobes can preclude complete surgical excision. On occasion, surgical cytoreduction can provide palliation of clinical signs and a better opportunity for adjuvant chemotherapy to have a positive effect. Most hepatobiliary tumors are slow growing and tend to push normal parenchyma out of the way, allowing for excision of even very large masses. Up to 80% of the functional liver can be removed without long-term functional deficits. In most cases, however, the tumor volume does not represent normal functioning liver, and this again lends to the ability to remove large solitary masses with little or no residual function deficit. Blood transfusions are often necessary during surgery of the liver. Stapling equipment (eg, TA staplers, GIA) allow rapid excision of solitary tumors.

### Hepatocellular Adenocarcinoma

Hepatocellular carcinomas occur in one of three forms. The first form is characterized by a single large mass, usually pedunculated. This form is sometimes termed the *massive form* of hepatocellular adenocarcinoma. These are easily amenable to excision via lobectomy or partial hepatectomy. The second form, known as the *nodular form*, is represented by infiltration of varying sized masses in all liver lobes. The third form is known as the *diffuse form* and is characterized by diffuse enlargement due to infiltration by non-

encapsulated, invading neoplastic tissue. The second two forms are not amenable to excision in most cases. Metastasis is common both to the liver and to distant organs such as the lungs in all the forms. In cases of solitary tumors, long remissions have been reported in animals that have had complete excision. Unfortunately, little has been published on the efficacy of chemotherapy for treatment of hepatic tumors in dogs and cats. In humans, primary liver tumors are thought to be relatively chemotherapy resistant.

### Hepatocellular Adenoma

These are the benign counterparts to the hepatocellular adenocarcinomas. Adenomas of the liver can become very large prior to clinical detection and may cause abdominal effusion. They are usually clearly demarcated from normal liver and are most commonly single masses. They can be difficult to grossly differentiate from the massive form of hepatocellular adenocarcinoma but on histology they are quite benign. They do not metastasize; therefore complete excision is curative.

### Cholangiocarcinoma (Biliary Carcinoma)

These tumors develop from intrahepatic or extrahepatic bile duct epithelial tissue. This tumor is more common in cats than in dogs. Cholangiocarcinoma is widely metastatic to local lymph nodes and the peritoneum resulting in effusions. It is estimated that metastasis occurs in about 87% of dogs and 78% of cats.

### SPLENIC TUMORS IN DOGS AND CATS

#### Hemangiosarcoma

Hemangiosarcoma is a malignant cancer of the blood vessel endothelial cells. It is the most common malignant tumor of the spleen. German shepherd dogs are known to be predisposed but the tumor occurs in other large breeds as well. Benign splenic tumors are also common, thus it is important not to presume all splenic tumors are hemangiosarcoma. Hemangiosarcoma can occur in any organ but is most frequently diagnosed in the spleen of dogs. Other primary sites include the right atrium, skin and subcutaneous tissue. It is uncommon in cats.

Splenic hemangiosarcoma is usually manifested by clinical signs of weakness, pallor, and collapse. Another common presenting scenario is a history of episodic weakness followed by recovery within 12 to 24 hours. The waxing and waning weakness followed by recovery is usually due to hemorrhage and subsequent autotransfusion of free abdominal blood (hemoperitoneum). Hemoperitoneum can be diagnosed via abdominocentesis. The finding of large amounts of free abdominal blood in an older, large breed dog, with the concurrent findings of weakness and anemia on presentation, should be considered consistent with a ruptured splenic tumor. In the absence of a palpable abdominal mass, an important diagnostic differential is rodenticide toxicity and the owners should be questioned carefully to determine if the patient might have been exposed. Depending on the timing of presentation

relative to the hemorrhage, the abdominal effusion may have been completely reabsorbed or a serosanguinous effusion may be present. Changes in red blood cell morphology such as acanthocytes, schistocytes, and nucleated red blood cells are commonly noted on the complete blood count in animals with hemangiosarcoma. Shistocytes are associated with red cell fragmentation and microangiopathy. The presence of these morphology changes on the complete blood count (CBC) should increase the clinician's index of suspicion for hemangiosarcoma.

Ventricular arrhythmias are a common finding in dogs with splenic tumors, especially in those that have ruptured and bled. These are most likely due to either myocardial hypoxia associated with severe anemia, or to myocardial depressant factors released by the tumor. Ventricular tachycardia can be present at the time of surgery but is commonly seen within 12 to 36 hours after surgery. Often, supportive management such as fluid therapy and correction of electrolyte imbalances will be sufficient support for the patient; however, in certain instances; the arrhythmias should be addressed medically. If the arrhythmias 1) interfere with cardiac output as evidenced by poor peripheral pulses or collapse, 2) are multiform, 3) have subsequent premature beats inscribed on the wave of the previous complex (R on T phenomenon) or 4) have a sustained ventricular rate of greater than 180 beats per minute, anti-arrhythmic drugs are indicated. Lidocaine given intravenously (IV) at 2 mg/kg bolus followed by a continuous rate infusion (CRI) of 50 µg/kg/min is effective in many patients. The CRI can be increased to 75 µg/kg/min if lower doses are ineffective. Procainamide 10–15 mg/kg IM or PO can be used when the animal is more stable. Procainamide at 10–15 mg/kg given IV as a slow bolus can be used if the arrhythmias do not respond to lidocaine therapy; however, severe hypotension can result. Up to 25% of dogs with splenic hemangiosarcoma may concurrently have right atrial hemangiosarcoma; therefore it is important to examine the right atrial appendage with ultrasonography for the presence of a mass. Metastasis to the lungs can be noted, emphasizing the importance of a complete staging workup.

A common benign mass, splenic hematoma, may also rupture and bleed into the abdomen and is an important differential diagnosis for hemangiosarcoma. Collapse, hemoperitoneum and anorexia are common signs with both conditions. Both are treated with splenectomy; however, the prognosis is drastically different and therefore it is important to distinguish between the two diseases.

Ruptured splenic tumors should be considered a surgical emergency. Animals presenting with an

abdominal mass, collapse, pallor, and hemoperitoneum should be treated for shock, given a transfusion of packed cells or whole blood and taken to surgery when stable. Although, some clinicians prefer to stabilize overnight, I find that a significant proportion of these patients are in disseminated intravascular coagulation (DIC) and are at risk for fulminant, lethal hemorrhage. Removal of the primary tumor is the best treatment to prevent or address DIC and many animals rapidly stabilize after surgery.

Treatment for splenic hemangiosarcoma is splenectomy followed by adjuvant chemotherapy. Splenectomy will relieve abdominal distention caused by the tumor and halt bleeding. It is very important to realize that one cannot distinguish between benign and malignant tumors of the spleen by gross examination. Similarly, the surgeon should avoid assuming that any lesions seen in the liver at the time of surgery are definitive metastases. Nodular hyperplasia may appear similar to metastatic disease; therefore, a liver biopsy is always indicated. The important message here is *never euthanize a patient suspected of having primary splenic hemangiosarcoma without histopathologic confirmation*, even if it appears that metastatic disease is present in the liver. Many clinicians have been grieved to find at necropsy that the primary splenic tumor was a benign hematoma and the nodules in the liver that were thought to be metastatic foci were nodular hyperplasia.

Splenectomy alone does not result in prolonged survival in patients with hemangiosarcoma as the tumor readily metastasizes to the liver and peritoneal cavity. Adjuvant chemotherapy is recommended for dogs with hemangiosarcoma and significantly improves survival time. At the University of Illinois we are using doxorubicin (30 mg/m<sup>2</sup>) in combination with dacarbazine (DTIC) at 200 mg/m<sup>2</sup> for dogs with hemangiosarcoma. Median survival is approximately 10 to 14 months with this protocol however this data is still maturing

#### **Other Splenic Tumors**

Other splenic tumors seen in dogs and cats include lymphoma, leiomyoma, leiomyosarcoma, mast cell tumors, hemangioma and malignant fibrous histiocytoma. Leiomyoma and hemangioma are benign tumors. Splenectomy is curative. Leiomyosarcomas and malignant histiocytoma are in the soft tissue sarcoma family and have the potential to metastasize. Little is published on long-term survival of patients with soft tissue sarcomas of the spleen but it is thought that they are slow to metastasize. Therefore, early detection and splenectomy can be curative in some cases. Chemotherapy is given if metastatic disease is documented.