



LEADERS IN SPECIALTY CARE

Arizona Veterinary Specialists' News

CANINE PRIMARY LUNG TUMORS

By Lynda Beaver, DVM, DACVIM

Arizona Veterinary Oncology



Dr. Beaver received her DVM from the Ontario Veterinary College in 1989. After working as a general practitioner for a number of years, she decided to specialize in the field of veterinary oncology so she spent 4 years as an oncology technician at the University of Wisconsin-Madison. She then completed a small animal medicine and surgery internship at the University of Illinois, and then an Oncology internship at Southern Arizona Veterinary Specialty and Emergency Center in Tucson, Arizona.

Dr. Beaver finished a three-year medical oncology residency at Arizona Veterinary Specialist in 2009, and became board-certified in medical oncology in 2010. Dr. Beaver works out of the Gilbert facility Tuesday through Friday.

GENERAL INFORMATION:

Primary lung tumors are uncommon in dogs, and represent about 1% of newly diagnosed tumors, although this number may be increasing. They occur more commonly in larger, older dogs with an average age of 10 to 11 years. The exact cause is unknown, but it is thought that chemical carcinogenesis (eg second hand smoke, urban environments) may play a role in the genesis of canine lung cancer. Studies have shown that dogs with short and medium-length noses are more susceptible to lung cancer because their shorter nasal passages are not as effective at accumulating the inhaled carcinogens, which results in more carcinogens reaching the lungs. In one study Boxer's were overrepresented. Most primary lung tumors are malignant, specifically carcinomas (about 97%), arising from the epithelium of the airways or alveolar parenchyma (bronchoalveolar carcinomas). Tumors that originate from the epithelium of

the large airways are typically located near the hilus, whereas tumors that originate from the pulmonary parenchyma are typically located in the periphery of the lung, most commonly the right caudal lung lobe potentially due to more lung tissue mass.

CLINICAL SIGNS:

Most patients will not present with overt clinical signs of respiratory distress, but more commonly primary lung tumors will be incidental findings during a routine health check (about 30% of patients have no clinical signs) or will be found when patients are evaluated for nonspecific signs of illness such as weight loss, lethargy, and decreased appetite. The most common respiratory clinical sign in dogs is a chronic nonproductive cough. Other respiratory signs may include tachypnea, wheezing, and exercise intolerance. Dyspnea may occur if a large portion of the lung is involved, or if secondary pleural effusion is present. Severe lameness

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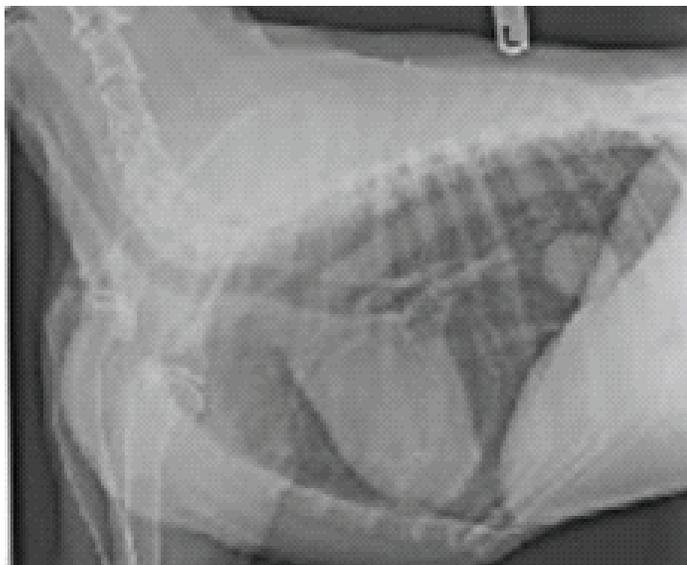
and pain may also be a presenting complaint if hypertrophic osteopathy or bone metastasis has occurred. Hypertrophic osteopathy is a paraneoplastic syndrome that is very uncommon, but can occur secondary to primary or metastatic lung tumors, and is characterized by periosteal new bone formation typically in the distal limbs, which causes pain and swelling.

DIAGNOSIS:

Physical exam is often normal in these patients, however, depending on the extent of disease in the lungs, and whether pleural effusion is present, respiratory rate and effort may be increased, and lung sounds may be abnormal. Baseline labwork, including a valley fever titer, is often the first step in the evaluation of these patients. This will help to evaluate overall health, look for evidence of infection, and evaluate for Valley fever, which, in this area, is a major differential in dogs with non-specific illness and especially a cough. The majority of lung tumors are diagnosed on thoracic radiographs. The appearance of primary lung tumors varies from a solitary mass, to involvement of an entire lung, or multiple lobes, indicating metastatic disease or multicentric pulmonary tumors, however, most commonly they appear as a well-defined solitary mass in the periphery of the lung. Radiographic assessment may be complicated by the presence of pleural effusion, which may occur

as a result of regional lymph node metastasis or extension of the cancer into the pleura. If pleural effusion is present, radiographs may be repeated after thoracocentesis and may reveal underlying mass(es). Differentials for pulmonary masses include primary lung tumors (77% in one study), fungal granulomas (especially in this region of the country), metastatic neoplasia (from a distant primary tumor or part of a multifocal disease process like histiocytic sarcoma), abscesses, cysts, and diaphragmatic hernias.

If confirmation of a diagnosis is desired, the easiest, least invasive, option is to perform a fineneedle aspiration (FNA) of the mass(es). This can be attempted with ultrasound-guidance under heavy sedation/anesthesia if the mass is close to the body wall, or with CT-guidance if the mass is more central, although this carries more risk as the needle goes through normal lung tissue. This has been shown to provided a definitive diagnosis in 38% to 90% of cases in which it is performed. If pleural effusion is



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present, cytology of the fluid will often provide a diagnosis. For solitary lung masses the decision may be made to forego sampling of the mass and move straight to surgery, as excision of the mass would be recommended regardless of etiology.

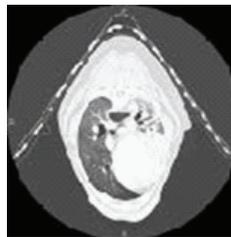
TREATMENT AND PROGNOSIS:

Surgery:

Surgery is the treatment of choice for solitary primary lung tumors, and a CT scan is recommended prior to surgery. CT scan's have been shown to be superior to radiographs in evaluating tracheobronchial lymph node involvement (93% vs 57% in one study), and the presence of metastatic nodules, both of which affect prognosis. In one study only 9% of CTdetected metastatic nodules were noted on chest x-rays.



A CT scan will also help to confirm the surgical resectability of the mass. While lung tumors most commonly spread within the lungs or to the regional lymph nodes, abdominal imaging, via ultrasound or CT scan, is also recommended, to evaluate for distant metastatic disease and to rule out other, unrelated, disease, especially as most of these patients are older. With surgery, the median survival time for dogs with primary lung tumors is about 1 year, with an



average range from 6 to 18 months. Metastasis to the tracheobronchial lymph nodes is the best predictor of remission and survival time for dogs with primary lung tumors treated with surgery.

Median survival times in dogs with positive lymph nodes based on assessment before or during surgery was 60 days, versus 285 to 345 days in patients with normal sized lymph nodes. Dogs with higher grade tumors, clinical signs at the time of diagnosis, and tumors that are greater than 5 cm in diameter have also been shown to have a more guarded prognosis.

Although complete surgical removal of the tumor provides the best prognosis, other options can be consider if surgery is not considered to be in the



pets best interest, or is not an option for the pet owner:

Chemotherapy:

Chemotherapy can be used to potentially shrink the tumor, or at least delay progression, for some period of time. Most dogs tolerate chemotherapy very well, with minimal to no side effects. For primary lung tumors, chemotherapy typically involves an IV drug called vinorelbine, which is given weekly for 4 weeks, then every other week pending response. In one study, partial

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responses were seen in 2/7 dogs with measurable bronchoalveolar carcinoma. Chest xrays are evaluated after the first 4 doses, and if the mass(es) are stable, or improved, treatment is continued. Low dose chemotherapy protocols, and tyrosine kinase inhibitors could also be considered in an effort to delay progression of disease.

Stereotactic radiation therapy (SRT):

Historically, radiation therapy has not been used to treat lung tumors in dogs, however, Arizona Veterinary Oncology is now excited to offer SRT which can be used to help treat patients with primary lung tumors. This type of radiation therapy allows the delivery of a curative dose of external beam radiation therapy in just a few treatments, with almost no risk of side effects. SRT, as opposed to conventional radiation therapy, is delivered in 1 to 3 treatments, as compared to traditional protocols which typically involve 15 to 19 treatments. This means fewer trips to the clinic, fewer anesthesia events, and less side effects, as this type of radiation therapy is applied so precisely that there is very little exposure to the normal surrounding tissue. Prior to treatment, a special immobilizer device is built for the patient, and a CT scan is done with the patient in the immobilizer device to allow for very precise planning and treatment of the tumor. This is a very new treatment modality in veterinary medicine, and there is not a lot of good information available as far as response rates, and prognosis. Our colleagues on the human side have shown that lung tumors smaller than 3 cm in size do just as well with SRT as they do with surgery without the morbidity and mortality so we are optimistic about this treatment being effective in animals as well.

We are happy to announce that starting in late February, 2017, we have a funded study taking place to evaluate this treatment. The cost to the client is around \$4500 total and includes the CT scan for planning and two follow-up CT scans in the future. All patients receive treatment (i.e. no placebo) with SRT. Please contact us for more details.

Palliative treatment:

In situations where more aggressive treatment is declined by pet owners, or is not appropriate for the pet, palliative treatment is pursued to try to keep the patient comfortable and feeling good for as long as possible. Prednisone will often help to decrease coughing in patients with lung cancer, stimulate appetite, and improve overall quality of life by decreasing inflammation. Cough suppressants and pain medications can also be used as needed.

While primary lung tumors are relatively uncommon in dogs, the incidence appears to be on the rise. The prognosis for dogs with small, solitary masses treated with surgery is good, so early detection is key. If surgery is not an option, chemotherapy and/or SRT may provide alternative options to help to delay tumor progression, and maintain quality of life.



LEADERS IN SPECIALTY CARE

April 2017

Arizona Veterinary Specialists, LLC
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Gilbert, Arizona 85233

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Our mission is to enhance the quality of our patients' lives, to strengthen the human-animal bond, and to provide a safe and stimulating work environment for all of our team members.

AVS CORE VALUES

INNOVATION

We will strive to discover and share knowledge that will continuously improve the veterinary profession.

EXCELLENCE

At Arizona Veterinary Specialists, our standard is excellence in all that we do and the way in which we do it.

COMPASSION

The spirit of all our relationships will be driven by compassion.

PATIENT CARE

We are committed to providing compassionate, ethical, and quality care to our patients. We treat them as if they are members of our own families.

INTEGRITY

We will conduct ourselves in a manner that will instill confidence and trust in all of our interactions.



Services Offered at Arizona Veterinary Specialists, LLC

Arizona Veterinary Dental Specialists, PLLC Dentistry

- ◆ Periodontics
- ◆ Dental digital radiography
- ◆ Root canals
- ◆ Nasal disease treatment
- ◆ Oral disease treatment
- ◆ Oral surgery
- ◆ Orthodontics
- ◆ Restoration
- ◆ Professional teeth cleaning
- ◆ Maxillofacial surgery
- ◆ Oral fractures
- ◆ Fractured teeth treatment
- ◆ Malocclusion treatment
- ◆ Crown therapy
- ◆ In house lectures
- ◆ Telephone radiographic consultation
- ◆ Bite evaluation

Arizona Veterinary Oncology, PLLC Radiation Oncology

- ◆ Conventional Radiation Therapy
- ◆ Stereotactic Radiosurgery
- ◆ I-131 radioactive iodine treatment

Medical Oncology

- ◆ Chemotherapy
- ◆ Immunotherapy
- ◆ Cryotherapy
- ◆ Oncologic surgery
- ◆ Clinical trials

Desert Veterinary Medical Specialists Internal Medicine

- ◆ Endoscopy
 - Bronchoscopy
 - Bronchoalveolar lavage
 - Colonoscopy
 - Cystoscopy
 - Foreign body retrieval
 - Gastroduodenoscopy
 - PEG tube placement
 - Rhinoscopy
- ◆ Endocrine disorders
- ◆ Emergency consultations
- ◆ Blood and plasma transfusions
- ◆ Gastrointestinal diseases
- ◆ Genitourinary disorders
- ◆ Hepatic diseases
- ◆ Infectious diseases
- ◆ Intensive care treatment
- ◆ Immune-mediated diseases
- ◆ Nutrition consultations
- ◆ Oxygen therapy
- ◆ Pancreatic diseases
- ◆ Pulmonary diseases
- ◆ Renal disease
- ◆ Respiratory diseases
- ◆ Second opinion examinations
- ◆ Ultrasonography
- ◆ Tracheal and urethral stenting

Cardiology

- ◆ Echocardiography
- ◆ Electrocardiogram (ECG)
- ◆ Chest radiographs
- ◆ Blood pressure
- ◆ Pericardiocentesis
- ◆ Cardiology breed certification
- ◆ Holter monitoring
- ◆ Event monitoring
- ◆ Non-surgical PDA repair
- ◆ Balloon valvuloplasty
- ◆ Pacemaker implantation
- ◆ Invasive blood pressure measurements
- ◆ Angiography

◆ Implantable ECG Loop Recording Radiology

- ◆ Outpatient and inpatient ultrasound
- ◆ Radiology Rounds
- ◆ Digital radiography
- ◆ Helical CT scanning
- ◆ Fluoroscopic urinary, GI, and tracheal studies
- ◆ Nuclear imaging
 - GFR scans
 - Bone scans
 - Thyroid scans
 - Splenic scintigraphy
- ◆ Radiographic interpretation
- ◆ CT and MRI interpretation

Dermatology for Animals, PC Dermatology

- ◆ Allergy testing (skin testing) and immunotherapy
- ◆ CO₂ laser for ablation of skin tumors
- ◆ Testing for food allergies and hypoallergenic diets
- ◆ Ear disease diagnosis and treatment
- ◆ Bacterial and fungal skin disease diagnosis and treatment
- ◆ Cytological smears and microbic examinations
- ◆ Ectoparasite identification and treatment
- ◆ Immune-mediated and hormonal skin disease diagnosis and treatment
- ◆ Treatments of nail and nail bed disorders
- ◆ Skin biopsy sampling and histopathology interpretation

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Southwest Veterinary Surgical Service, PC Surgery

- ◆ Abdominal surgery
- ◆ Airway surgery
- ◆ Angular limb deformity surgery
- ◆ Arthroscopy
- ◆ CT Scans
- ◆ External skeletal fixation
- ◆ Fracture repair
- ◆ Laparoscopy and Thoracoscopy
- ◆ Neurologic surgery
- ◆ Oncologic surgery
- ◆ Oral surgery, such as maxillofacial surgery and oral fractures
- ◆ Orthopedic surgery
- ◆ Otolgic surgery
- ◆ Perineal surgery
- ◆ Reconstructive surgery
- ◆ Ring fixators
- ◆ Soft Tissue surgery
- ◆ Thoracic surgery
- ◆ Tibial Plateau Leveling Osteotomy (TPLO)
- ◆ Triple Pelvic Osteotomy (TPO)
- ◆ Total Hip Replacement (THR) both cemented and cementless procedures available
- ◆ Tracheal Stenting
- ◆ Tibial Tuberosity Advancement (TTA)

Anesthesia and Pain Management

- ◆ Anesthetic management of high risk and critical care patients
- ◆ Extensive anesthesia monitoring
 - Blood pressure, both direct and indirect
 - Pulse oximetry
 - Electrocardiogram
 - Capnography
 - Body temperature
 - Ventilator therapy
- ◆ Pain patches
- ◆ Chronic pain management consultations

BluePearl Veterinary Partners, PLC Emergency and Critical Care

- ◆ In house diagnostic tests
 - STAT laboratory blood tests
 - * Complete Blood Count (CBC)
 - * Serum biochemical analysis
 - * Blood gas analysis
 - * Urinalysis
 - * Blood lactate measurement
 - * Coagulation testing
 - * Ethylene glycol (Antifreeze) testing
 - * Parvovirus testing
 - Digital x-rays
 - * Radiologist interpretation
 - Scanning ultrasound
 - Gastrointestinal endoscopy
- ◆ Specialized Therapies
 - Intravascular volume expansion/shock therapy
 - Blood component therapy
 - Rattlesnake antivenom therapy
 - Oxygen
 - Short and long term ventilator therapy
 - Anesthetic ventilator
 - Pain medication delivery via constant rate infusion
 - Nutritional support
 - Feeding tube placement
 - Peritoneal dialysis
 - Continuous suction for chest and other drains
 - Central and peripheral IV catheter placement
 - CPR with advanced life support
 - Electrical defibrillation & emergency cardioversion
 - Anesthesia for high-risk critical patients

- ◆ Soft tissue emergency surgical procedures performed by our emergency veterinarians (included, but not limited to):
 - Wound repair
 - Emergency tracheostomy
 - Chest tube placement
 - Abdominal surgeries
 - Gastric Dilatation Volvulus (GDV) or bloat surgery
 - GI foreign body removal
 - C-section
 - Splenectomy
 - Bladder stone removal
- ◆ Intensive monitoring
 - Electrocardiogram (EKG)
 - Blood pressure (direct arterial and indirect)
 - Urinary catheter placement and measurement of urine output
 - Pulse oximetry (Oxygen saturation)
 - Capnography (End Tidal CO₂)
 - Central venous pressure
 - Arterial and venous blood gas measurement

Eye Care for Animals, dba Ophthalmology

- ◆ Biomicroscopy
- ◆ Indirect ophthalmoscopy
- ◆ Electroretinography
- ◆ Ultrasonography
- ◆ Applanation tonometry
- ◆ Fluorescein angiography
- ◆ Glaucoma treatment
- ◆ Cataract surgery
- ◆ Corneal reconstructive surgery
- ◆ Treatment of eyelid abnormalities

AVS Specialty Practices

Southwest Veterinary Surgical Service, PC

- ◆ Bradford C. Dixon, DVM, MS
Diplomate, American College of Veterinary Surgeons
- ◆ Jeffrey A. Steurer, DVM, MS
Diplomate, American College of Veterinary Surgeons
- ◆ Kathleen M. Rowe-Guthrie DVM, MS
Diplomate, American College of Veterinary Surgeons
- ◆ Rachel Seibert, DVM, CCRP
Diplomate, American College of Veterinary Surgeons
- ◆ Megan Schaible, DVM
(Practice Limited to Surgery)

Arizona Veterinary Dental Specialists, PLLC

- ◆ Chris Visser, DVM
*Diplomate, American Veterinary Dental College
Diplomate, European Veterinary Dental College*
- ◆ Curt Coffman, DVM
Diplomate, American Veterinary Dental College
- ◆ Michael Balke, DVM
(Practice Limited to Dentistry and Oral Surgery)

Arizona Veterinary Oncology, PLLC

- ◆ Eric Boshoven, DVM
Diplomate, American College of Veterinary Radiology (Radiation Oncology)
- ◆ Lynda Beaver, DVM
Diplomate, American College of Internal Medicine (Medical Oncology)
- ◆ Rachel Venable, DVM, MS
Diplomate, American College of Internal Medicine (Medical Oncology)

BluePearl Veterinary Partners, PLC

- ◆ Brandi Mattison, DVM
Diplomate, American College of Veterinary Emergency and Critical Care
- ◆ Raegan Wells, DVM, MS
Diplomate, American College of Veterinary Emergency and Critical Care
- ◆ Katherine Smith, DVM
Diplomate, American College of Veterinary Emergency and Critical Care

Dermatology for Animals, PC

- ◆ Thomas P. Lewis II, DVM
Diplomate, American College of Veterinary Dermatology
- ◆ Anthea E. Schick, DVM
Diplomate, American College of Veterinary Dermatology
- ◆ Rebecca Mount, DVM
Diplomate, American College of Veterinary Dermatology
- ◆ Carine Laporte, VMD
(Practice Limited to Dermatology)
- ◆ Samantha Lockwood, DVM
(Practice Limited to Dermatology)
- ◆ Stephanie Schwartz, DVM
(Practice Limited to Dermatology)

Eye Care for Animals, dba

- ◆ Lisa M. Felchle, DVM
Diplomate, American College of Veterinary Ophthalmology
- ◆ Paul M. Barrett, DVM
Diplomate, American College of Veterinary Ophthalmology

Desert Veterinary Medical Specialists

- ◆ Victoria Heffelman, DVM
Diplomate, American College of Veterinary Radiology
- ◆ Whit M. Church, DVM
Diplomate, American College of Veterinary Internal Medicine (Cardiology)
- ◆ Melissa Riensche, DVM
Diplomate, American College of Veterinary Internal Medicine

