ONCOLOGY

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PULMONARY NEOPLASIA: THE SURGEON'S APPROACH

Primary pulmonary neoplasia is less common than metastatic neoplasia in dogs and cats. The diaphragmatic lobes are most frequently involved, with the right lung lobes more often affected than the left. Specific anatomic localization of tumor origin is not always possible, and more than one tumor type may be present; therefore, classification of primary lung tumors usually is based on the predominant histologic pattern.

Adenocarcinoma is the most common histologic type found in dogs and cats; squamous cell carcinoma and anaplastic carcinomas are less common. Primary pulmonary tumors of connective tissue origin (e.g., osteosarcoma, fibrosarcoma, and hemangiosarcoma) are rare. Although most pulmonary tumors are malignant, benign tumors (i.e., papillary adenoma, bronchial adenoma, fibroma, myxochondroma, and plasmacytoma) occur. Pulmonary neoplasms are highly aggressive and tend to metastasize early. Most anaplastic carcinomas and squamous cell carcinomas have metastasized at the time of diagnosis, whereas approximately half of adenocarcinomas have done so. Metastasis is often to the lung itself or to regional lymph nodes or both.

Metastatic pulmonary neoplasia is an important differential diagnosis for nodular lung disease. Tumors with a high likelihood of resulting in pulmonary metastasis include mammary carcinoma, thyroid carcinoma, hemangiosarcoma, osteosarcoma, transitional cell carcinoma, squamous cell carcinoma, and oral and digital melanoma.

Physical Examination Findings
The most common clinical finding in dogs with primary pulmonary neoplasia is a nonproductive cough; other signs include hemoptysis, fever, lethargy, exercise intolerance, weight loss, dysphagia, and anorexia. Lameness may be associated with metastasis to bone or skeletal muscle or with development of hypertrophic osteopathy or in feline lung-digit syndrome. Hyporexia, weight loss, lethargy, dyspnea, and cough are common clinical signs in cats with primary lung tumors; respiratory signs may be present in as few as one third of affected cats.

Diagnostic Imaging
Thoracic radiographs should be obtained in animals suspected of having pulmonary neoplasia. The most common finding with primary pulmonary neoplasia in dogs is a solitary nodular density in the periphery of a dorsocaudal lung lobe. Multiple miliary lesions are less common. The radiographic pattern may be classified as solitary nodular, multiple nodular, or disseminated-infiltrative. Multiple discrete lesions within a single lobe or multiple lobes usually represent metastatic neoplasia rather than multicentric primary neoplasia. Feline bronchoalveolar carcinoma may appear as a mixed bronchoalveolar pattern, an ill-defined alveolar mass, or a mass with cavitation. Bronchial disease is typically seen in affected cats (i.e., bronchointerstitial pattern, peribronchial cuffing, or bronchiectasis) and may represent airway metastasis. Because radiographic signs of pulmonary neoplasia in cats are not specific (many inflammatory diseases will cause similar changes), lung fine-needle aspirates may be the most helpful diagnostic tool.

Thoracic evaluation should include a three-view radiographic study (opposite lateral views and an orthogonal view). Lung lesions may go undetected in recumbent lateral radiographs when the affected lung is dependent because of the recumbent atelectasis that occurs. Thoracic radiographs are relatively insensitive indicators of pulmonary neoplasia because nodules must be at approximately 0.5 to 1 cm in diameter to be reliably recognized. Radiographs should also be evaluated for sternal or hilar lymphadenopathy and/or pleural effusion. It may be difficult to differentiate metastatic pulmonary neoplasia from pulmonary metastasis of a primary pulmonary tumor. Compared with primary lesions, metastatic tumors generally are smaller and more well circumscribed and usually are located in the peripheral or middle portions of the lung. Multiple nodules associated with primary lung tumors often consist of one large mass and smaller secondary nodules. When multiple nodules are metastases, there are usually several large masses and a variety of smaller lesions. Contrast-enhanced CT is the most sensitive means for detecting pulmonary lesions.

Diagnoses obtained by fine-needle aspiration (ultrasound-guided and blind) cytopathology accurately reflect the diagnosis obtained on histopathologic examination. CT-guided intrathoracic fine-needle aspiration and core biopsies are

also diagnostically accurate. Complications include pneumothorax and pulmonary hemorrhage that uncommonly require treatment. Use of fine-gauge (25- or 27-gauge) needles may reduce complications.

Surgical Treatment

Wide surgical resection is the treatment of choice for solitary nodules or multiple masses involving a single lobe if there is no evidence of distant metastasis or extrapleural involvement. Surgical resection occasionally is indicated for lung metastasis of a distant primary tumor (e.g., limb osteosarcoma). An intercostal thoracotomy is preferred over median sternotomy because it provides adequate exposure for lobectomy and lymph node biopsy. Partial lobectomy should be performed only when the tumor is located at the periphery of the lung lobe; otherwise, total lobectomy should be performed. Thoracoscopy can help determine whether pulmonary metastasis is present before a thoracotomy, particularly if the presence of metastasis is an important factor in determining whether resection of the pulmonary mass should be performed. Successful thoracoscopic or thoracoscopic-assisted lung lobectomy for primary lung tumors has been described. When compared to open thoracotomy, the only significant difference was longer surgical time with thoracoscopy, while completeness of excision, hospitalization time, complication rate, short-term survival, and median survival times were similar.

Prognosis

The prognosis is favorable for dogs with well-differentiated, nonmetastasized, primary lung tumors that do not have associated clinical signs. Dogs with tumors in the lung periphery or near the base of a lung have better survival times than those in which the tumor involves an entire lobe. The most important prognostic factor related to survival in dogs after surgery is whether lymph node metastasis has occurred. Two-year survival rate following lung lobectomy in dogs is approximately 50%.

The prognosis for most cats with primary lung tumors is often poor because of the advanced nature of the disease at the time of diagnosis and the tumors' aggressive metastatic behavior. In one study overall median survival time in cats is 156 days; lymph node involvement is also prognostic (65 with lymph node enlargement versus 498 days without lymph node enlargement). Cats with low or intermediate grade tumors had a median survival of 730 days compared to 105 days for cats with high grade tumors. In a separate study, median survival time was only 11 days with the following factors correlating with reduced survival time: clinical signs at the time of diagnosis, pleural effusion, stage M1, and poorly differentiated tumor type. Cats with no clinical signs on presentation had a median survival time of 578 days.