

# FUNGAL PNEUMONIA

## BASICS

### OVERVIEW

- Inflammation of the interstitial, lymphatic, and peribronchial tissues of the lung, caused by deep fungal (known as “mycotic”) infection; “interstitial” relates to spaces within tissues or organs; “lymphatic” refers to vessels within the body that transports lymph, a clear to slightly colored liquid that contains white-blood cells—it serves many functions including removing bacteria from tissues and returning fluids to the circulation; “peribronchial” refers to something that surrounds the bronchus or bronchi (airways going from the windpipe [trachea] into the lungs)
- Various fungi can cause “deep fungal infections;” they include *Blastomyces*, *Histoplasma*, *Coccidioidomyces*; *Cryptococcus*; and *Aspergillus*; the fungi are found in different locations in the United States
- Depends on geographic distribution in the United States: Blastomycosis—seen in the Southeast and Midwest, along the Mississippi, Ohio, Missouri, and Tennessee Rivers and southern Great Lakes; also in southern Midatlantic states; Histoplasmosis—similar to, but more widely distributed than, blastomycosis; pockets of disease in Texas, Oklahoma, and California; Coccidioidomycosis—Southwest from Texas to California; Cryptococcosis and Aspergillosis—widespread throughout the United States
- “Pneumonia” is inflammation of the lungs

### GENETICS

- Breed susceptibilities may be related to defects in cell-mediated immunity

### SIGNALMENT/DESCRIPTION of ANIMAL

#### Species

- Dogs and less commonly in cats

#### Breed Predislection

- Generalized (systemic) disease caused by a fungus (known as “systemic mycosis”)—large-breed dogs kept outdoors or used for hunting or field trials; Doberman pinschers and rottweilers may be susceptible to more severe wide-spread (disseminated) disease
- Generalized (systemic) disease caused by *Aspergillus* (known as “aspergillosis”)—German shepherd dogs may be overrepresented in population of affected dogs

#### Mean Age And Range

- Young animals (less than 4 years of age) are more susceptible than other ages
- Any age may be affected

#### Predominant Sex

- Males affected 2 to 4 times more often than females

### SIGNS/OBSERVED CHANGES in the ANIMAL

- Depend primarily on the organ systems involved
- Illness affecting many body systems
- Chronic weight loss and lack of appetite (inappetence)
- Fever
- Discharge from eyes and/or nose
- Coughing—may be prominent; seen inconsistently even with severe lung disease; may be triggered by putting pressure on or feeling the windpipe or trachea
- Difficulty breathing (known as “dyspnea”) or exercise intolerance common; difficulty breathing may be noted when the animal is resting, if severe disease
- Labored breathing—more common in cats; sign of severe disease in both dogs and cats
- Sudden (acute) blindness or squinting of the eyes (known as “blepharospasm”)—if eyes are affected
- Raised bumps (known as “papules”) and nodules on the skin—common, but often missed until draining tracts appear
- Lameness—common if the feet are affected or if inflammation/infection of the bone (known as “osteomyelitis”) develops
- Depression and emaciation—in patients with long-term (chronic) disease
- Fever—about 50% of patients
- Harsh, loud breath sounds—common when listening to the lungs with a stethoscope (known as “auscultation”)
- Short, rough snapping sounds (known as “crackles”) may be heard when listening to the lungs with a stethoscope (auscultation)—may be prominent, especially in cats
- Blastomycosis—multiple nodules on and under the skin, with draining tracts; inflammation of the iris and other areas in the front part of the eye (known as “uveitis”); loss of attachment of the retina, the back part of the eye, characterized by the presence of multiple nodules (known as “granulomatous retinal detachment”) common
- Coccidioidomycosis (dogs)—severe pain caused by inflammation/infection of the bone (osteomyelitis) common
- Histoplasmosis (dogs)—emaciation and diarrhea (often bloody) prominent

- Cryptococcosis—infection involving the nasal passages and surrounding soft tissue is common

### CAUSES

- *Blastomyces dermatitidis*—lungs are the primary route of infection
- *Histoplasma capsulatum*—lungs and possibly gastrointestinal tract are the primary routes of infection
- *Coccidioides immitis*—lungs are the primary route of infection
- *Cryptococcus neoformans*—nasal cavity is the primary route of infection, with direct extension into the eyes or central nervous system (brain, spinal cord)
- *Aspergillus*—nasal cavity and lungs are the primary routes of infection

### RISK FACTORS

- Blastomycosis, histoplasmosis, and cryptococcosis—environmental exposure to soils rich in organic matter; exposure to bird droppings or other fecal matter may make patient susceptible to blastomycosis and cryptococcosis
- Coccidioidomycosis—environmental exposure to sandy, alkaline soil after periods of rainfall; outdoor activities (such as hunting and field trials); decreased ability to develop an immune response (immunosuppression), especially poor cell-mediated immunity, may contribute to generalized (systemic) spread of fungal infection
- Cats—feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV) infection
- Prednisone—may worsen the disease
- Chemotherapy
- Cancer involving certain cells in the lymph nodes, spleen, and/or bone marrow (known as “lymphoreticular cancer”)

### TREATMENT

#### HEALTH CARE

- Outpatient—if patient is still eating
- Inpatient evaluation and treatment—if patient is dehydrated, has lack of appetite (anorexia), and has severely low levels of oxygen (known as “severe hypoxia”)
- Administration of fluids, potassium, oxygen, and antibiotics, as needed

#### ACTIVITY

- Restricted

#### DIET

- Feed high-protein, calorically dense food
- Histoplasmosis, accompanied by severe gastrointestinal involvement—feed highly digestible food

#### SURGERY

- Localized, inflammatory nodules (known as “granulomas”) involving the eyes or painful eyes due to secondary glaucoma (in which the pressure within the eye is increased) may require surgical removal of the eye(s)

### MEDICATIONS

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

- Itraconazole—drug used to treat fungal infections; it is considered to be an “antifungal drug;” most often used first; must be given with food
- Fluconazole—antifungal drug; drug of choice for cryptococcosis and patients with central nervous system (brain, spinal cord) or urinary tract involvement
- Lipid-complexed amphotericin B—antifungal drug; administered intravenously (IV)
- Ketoconazole—antifungal drug; may be effective; higher incidence of side effects; longer treatment is necessary; relapse is common
- Amphotericin B—antifungal drug; administered intravenously (IV); may be used in combination with azole drug, such as itraconazole or ketoconazole for severely affected patients
- Amphotericin B—alternative; may give under the skin (subcutaneously) diluted in 0.45% saline/2.5% dextrose solution
- Voriconazole—antifungal drug; used for invasive aspergillosis, in which the deep fungal infection spreads through various tissues of the body

### FOLLOW-UP CARE

#### PATIENT MONITORING

- Liver enzymes—evaluated monthly by blood tests, while patient is on itraconazole, fluconazole, or ketoconazole

- Blood urea nitrogen (BUN) and creatinine—measure before each dose of amphotericin B, to monitor effects on the kidneys
- Chest X-rays—re-evaluate before discontinuing treatment

#### **PREVENTIONS AND AVOIDANCE**

- Monitor for signs of recurrence

#### **POSSIBLE COMPLICATIONS**

- Blindness is usually permanent
- Kidney failure from treatment with amphotericin B

#### **EXPECTED COURSE AND PROGNOSIS**

- Blastomycosis—requires a minimum of 2 months of treatment; 60% to 70% of dogs are cured by treatment with itraconazole; those not cured usually relapse
- Other deep fungal infections—continue until 1 month past remission
- Generalized (systemic) aspergillosis—prognosis not as good as for other fungal causes
- Relapse—may occur up to 1 year after treatment

#### **KEY POINTS**

- Less than 70% of dogs and a smaller percentage of cats are likely to respond to treatment
- Treatment is expensive and will probably be necessary for more than 2 months
- Clean environmental areas that have high organic matter or feces (take appropriate precautions to protect yourself from breathing in material in the area; you may want to consult with your physician first)

