

# Epidemiology, Diagnosis, and Treatment of Blastomycosis in Dogs and Cats

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**Blastomycosis is one of the most common systemic fungal diseases in dogs in North America, but it is rarely diagnosed in cats. The typical route of infection is inhalation of aerosolized conidia of *Blastomyces dermatitidis*. From the respiratory tract, the developing yeast form may disseminate throughout the body and affect multiple organ systems, most commonly the lymphatic, skeletal and central nervous systems, eyes and skin. Disseminated disease often is associated with nonspecific signs of illness including lethargy, inappetence and fever, as well as signs referable to specific organ systems like chronic cough and dyspnea, peripheral lymphadenopathy, endophthalmitis, and central nervous signs. Diagnosis is typically made by detection of *Blastomyces dermatitidis* yeast in affected tissues by fine-needle aspiration cytology or histopathology. The treatment of choice is itraconazole. Prognosis is fair in dogs without central nervous disease and guarded in cats.**

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Blastomycosis is a systemic fungal disease, most commonly diagnosed in dogs and humans, but also reported in cats,<sup>1</sup> horses,<sup>2</sup> and other mammals. It is endemic in the central and southeastern United States including the Ohio and Mississippi River Valleys, in the Great Lakes region, and in parts of Canada (Ontario, Manitoba, Southern Saskatchewan).<sup>3,4</sup> Reports of the disease in a cat<sup>1</sup> and in dogs<sup>5</sup> in New York state, Wyoming, South Dakota,<sup>6</sup> and in Colorado (humans)<sup>7</sup> show sporadic clustering of the disease outside known endemic areas. Blastomycosis also is endemic in Africa<sup>5,8</sup> and India.<sup>8,9</sup> In dogs, the highest-risk group for blastomycosis consists of young dogs from large breeds, especially intact males.<sup>10,11</sup> Sporting dogs and hounds,<sup>10</sup> and specifically Labrador Retrievers, Golden Retrievers, and Doberman Pinschers<sup>11</sup> are more frequently affected than other dogs. Proximity to a body of water also is a significant risk factor.<sup>11</sup> Blastomycosis is rare in cats and constitutes 41 of 571 (7%) feline cases with deep mycotic infections, with the highest reported incidences in Oklahoma, Tennessee, and Wisconsin. About 70% of these cases affected male cats, and about 42% of cats were less than 4-years-old.<sup>12</sup>

The causative agent is *Blastomyces dermatitidis* (*B. dermatitidis*), discovered in 1894 by Gilchrist at Johns Hopkins University ("Gilchrist's disease").<sup>13</sup> *Blastomyces* is a thermally dimorphic fungus, existing in the mycelial and yeast forms. The infectious form in the environment and soil is the mycelial phase. It produces microscopic conidia that mammals can inhale.<sup>11</sup> Outbreak investigations of blastomycosis disclosed infectious foci in areas of moist soil with high organic content, especially in areas of soil disruption (eg, construction sites) promoting aerosolization of conidia.<sup>14,15</sup> *B. dermatitidis* may be relatively persistent on certain properties. It has also caused disease in dogs and cats confined primarily to the home; the basement and attic were identified as the most likely sources of infection in these cases.<sup>16</sup> Another report describes isolation of *B. dermatitidis* from a woodpile at the Wisconsin River; over 14 years, 4 of 9 dogs housed close to the woodpile had been diagnosed with blastomycosis.<sup>17</sup>

Within the host's body, *Blastomyces* is a broad-based budding yeast with thick, double-contoured walls and granular basophilic internal structures.<sup>18,19</sup> Antigenic variance in *B. dermatitidis* isolates<sup>20</sup> and genetic differences (genotypes A, B, and C)<sup>8</sup> in different geographical regions are evidence for the genetic and geographic diversity of this fungus.

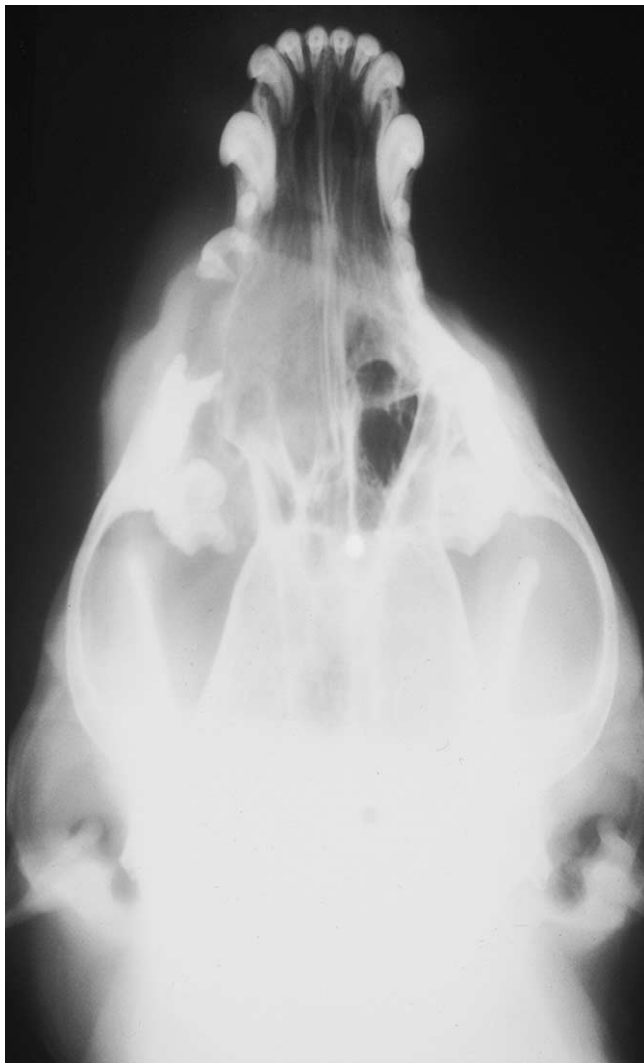
## Pathogenesis

Typically, infection with *B. dermatitidis* occurs when conidia produced from the mycelial phase in soil or decaying matter are inhaled into the lungs. Direct inoculation of the organism via skin puncture wounds is rare

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**Figure 1** Open-mouth ventrodorsal skull radiograph of a 2-year-old female intact German Shorthaired Pointer. Note the soft tissue swelling and increased opacity of the right nasal cavity with destruction of nasal turbinates and surrounding bony structures as well as tooth loss secondary to *Blastomyces* osteomyelitis.

(inoculation blastomycosis).<sup>21</sup> The increase in temperature within the body causes conversion from the spore phase to a large broad-based budding yeast cell.<sup>22</sup> Phagocytes are the first line of cellular defense, and complement is a key mediator of the adherence of *B. dermatitidis* yeast to canine macrophages. Yeast exhibit enhanced growth in the presence of canine macrophages because of the release of a soluble factor.<sup>23</sup> Furthermore, yeast cells synthesize melanin or melanin-like pigment in the canine lung. Melanin has been identified as a fungal virulence factor and may affect the pathogenesis of blastomycosis; melanized *B. dermatitidis* yeast cells are less susceptible to amphotericin B, but not to itraconazole.<sup>24</sup>

Local pulmonary disease ranges from a self-limiting infection to severe pyogranulomatous pneumonia.<sup>25,26</sup> The organism may disseminate via the vascular or lymphatic system, causing granulomatous or pyogranulomatous inflammation in many organs, including lymph nodes, eyes, bones, brain, meninges, kidneys, liver, spleen, skin, and subcutis.<sup>4,6,27-29</sup> The respiratory tract, lymphatics, eyes,

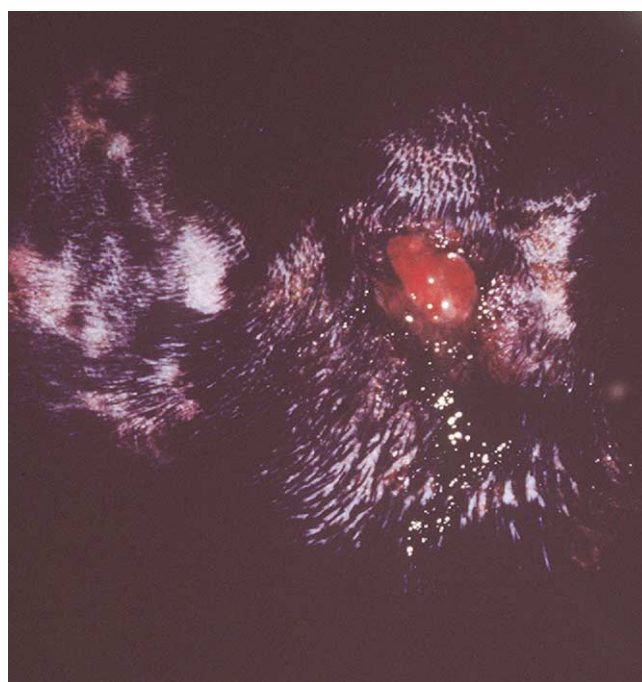
skin,<sup>10,11</sup> and bones (Fig. 1) are most commonly affected. Seventy-three of 152 dogs (48%) with blastomycosis had ocular involvement.<sup>30</sup>

## Clinical Signs and Physical Examination Findings

### Dogs

Dogs are commonly presented for signs related to a single organ system, but further diagnostics usually reveal multisystemic involvement. The clinical course of the disease may include temporary improvement on supportive care and antibiotic treatment; patients are represented days to weeks later when signs reoccur. Clinical signs range from nonspecific (lethargy, weakness, anorexia, and weight loss) to more specific signs including cough, increased respiratory rate, lameness, or reluctance to walk.<sup>4,6,11,26-28,31-33</sup> Lameness may be associated with *Blastomyces* arthritis and periostitis,<sup>33</sup> osteomyelitis<sup>21,34</sup> or, rarely, with hypertrophic osteopathy.<sup>31</sup> Other clinical signs include localized soft tissue or bony swellings,<sup>11</sup> blindness, seizures or other neurological signs, hemoptysis,<sup>26</sup> hematemesis, melena, polyuria, polydipsia, and lumbar pain.<sup>6</sup>

Common findings on physical examination are fever, peripheral lymphadenopathy,<sup>11,26</sup> dyspnea or tachypnea,<sup>26</sup> increased breath or lung sounds,<sup>11,27,33,35</sup> and subcutaneous abscesses<sup>4,27,28,34</sup> or ulcerative draining lesions of the skin (eg, muzzle, digits, body wall) (Fig. 2)<sup>11,25,27,33</sup> or oral mucosa.<sup>4,33</sup> Ocular discharge, conjunctivitis, keratitis, chorioretinitis, uveitis, photophobia, and impaired vision or blindness are findings suggestive of ocular involvement.<sup>11,28,33</sup> In ocular blastomycosis, endophthalmitis is most common, followed by posterior segment disease and rare anterior segment disease.<sup>30</sup> In dogs with endophthalmitis, the most common anterior segment abnormality is anterior uveitis, with changes



**Figure 2** Draining skin lesion in the right shoulder area of a dog with cutaneous blastomycosis.

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