

# Coccidioidomycosis

*Valley Fever; San Joaquin Fever;  
Desert Rheumatism*

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## Importance

Coccidioidomycosis is a non-contagious infection that affects numerous species and is endemic in the southwestern United States, parts of Mexico, and South America. There are approximately 100,000 human cases each in year in the U.S. The disease can be fatal, especially in the elderly or immunocompromised. Persons afflicted with HIV/AIDS are highly susceptible to coccidioidomycosis and suffer a high mortality rate from the disease.

## Etiology

Coccidioidomycosis results from direct inhalation of the spores of the dimorphic fungus *Coccidioides immitis* from the soil or from dust in the air. The disease varies from asymptomatic to progressive and possibly fatal. The disease occurs in two forms: primary, which is usually asymptomatic, and progressive, which occurs weeks to years after primary infection and, if disseminated, can be fatal if untreated.

## Species affected

*Coccidioides immitis* can cause disease in many species of animals, including man. Dogs are the most severely affected non-human species.

## Geographic distribution

Coccidioidomycosis is endemic in the southwestern U.S., including parts of New Mexico, Texas (west of El Paso), the central valley of California, and Arizona (where the incidence in humans is particularly high). The endemic area extends into northern Mexico, and foci of infection are present in parts of Central America and Argentina. In endemic areas, 10–50% of the human population are skin test positive for coccidioidomycosis infection.

## Transmission

Coccidioidomycosis is not communicable from person-to-person or animal-to-animal. Inhalation of *C. immitis* spores, which may be carried on dust particles or present in contaminated soil, is the only established mode of transmission. The rate of infection is increased following a disturbance of soil contaminated with fungal spores. Soil is commonly disturbed either by humans (as in an archaeological dig or construction site) or by natural causes such as an earthquake or dust storm. Placental infection has been reported in horses, but is rare.

## Disinfection

Although fungal agents are highly resistant to most disinfectants, halogens (such as iodine, and chlorine in the form of hypochlorite [bleach]), phenolics (such as Tek-Trol ), and quaternary ammoniums (Di-Quat 10-S and Roccal -D Plus) have proven effective against *Coccidioides immitis*.

## Infections in Humans

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### Incubation period

The incubation period for the less severe form of infection ranges from 7 to 21 days. In the case of chronic pulmonary coccidioidomycosis, the disease can develop 20 or more years following an initial infection that may not have been recognized.

### Clinical Signs

In the less severe form, primary coccidioidomycosis, the disease is usually subclinical. When present, symptoms include fever, cough, chest pain, chills, sputum production, sore throat, and occasionally hemoptysis. Nonspecific respiratory symptoms resembling acute bronchitis or influenza may occur, and complications such as pneumonia or pleural effusion occur less commonly. Nodular lesions may result from the resolution of primary

pulmonary lesions and must be distinguished from nodules associated with tuberculosis or other granulomatous lesions.

Progressive or disseminate coccidioidomycosis is the more severe form of the disease, and may develop weeks, months or years after the primary infection. This form of infection is more common in men, immunocompromised persons, elderly and certain ethnicities such as Filipino, African–American, Native American, Hispanic, and Asian. Symptoms include a low–grade fever, anorexia, weight loss, muscle aches and stiffness, excessive sweating, and weakness. Mucopurulent or bloody sputum may be present when there is extensive pulmonary involvement, which may develop in HIV–infected persons. Focal lesions may be found in the bones, joints, skin, subcutaneous tissues, liver, kidneys, lymph nodes, brain and meninges; deeper lesions in the skin may result in connections of draining sinus tracts.

## Communicability

Coccidioidomycosis is not passed from person–to–person or from animal–to–person; inhalation of the airborne fungal spores in dust or soil is the only established mode of transmission.

## Diagnostic Tests

Immediately following inhalation, *C. immitis* spores convert to large tissue–invasive spherules (ranging from 20–80  $\mu\text{m}$  in diameter) which can be visualized in sputum, pleural fluid, cerebrospinal fluid, and exudates from draining lesions. Diagnosis can also be established by culturing the infected body fluids or tissue specimens. Complement fixation for IgG anticoccidioidal antibodies is the most useful diagnostic test, as the severity of infection can be assessed by the titer. Titers  $\geq 1:4$  in serum indicate current or recent infection, while higher titers ( $\geq 1:32$ ) indicate an increased risk of extrapulmonary dissemination. Titers also reflect the efficacy of treatment, as they generally decline with successful therapy. Coccidioidal meningitis is diagnosed by the presence of complement fixing antibodies in cerebrospinal fluid. The coccidioidin skin test is more valuable in epidemiologic studies than diagnostically because it is positive in most persons in endemic areas.

## Morbidity and Mortality

The rate of infection is directly proportional to the degree of exposure to airborne spores, i.e., individuals exposed to large amounts of dust in endemic areas have higher rates of infection. Sixty percent of *Coccidioides immitis* infections are asymptomatic and are recognized only in a positive skin test, and the remaining forty percent of cases show symptoms ranging from mild to severe, and are usually pulmonary. About 90% of these cases will resolve their pulmonary infections without sequelae. Immunocompromised persons are more susceptible to serious infection, and the mortality

rate in HIV–infected persons exceeds 70% within one month of diagnosis. Meningitis occurs in approximately 30–50% of untreated disseminated coccidioidomycosis cases, and is almost invariably fatal after this point.

## Treatment and Vaccination

Treatment for patients with primary coccidioidomycosis is generally unnecessary (usually only about 5% of cases require treatment) unless complement fixation titers indicate spread of the infection, which requires treatment with antifungal agents. If the case is very severe (such as an AIDS–associated case), maintenance therapy to prevent relapse may be necessary. Although efforts are being made to develop a successful vaccine, there is no effective immunization available yet.

## Post Mortem Lesions [Click to view images](#)

A wide variety of exanthems, including maculopapular lesions, may be present on the skin. Bronchitis, pneumonia, pleural effusions and reactive airway disease are common in the pulmonary system. Bone lesions are focal in the majority of cases (60%), and joint lesions are focal in 90% of cases. Lymphadenopathy has also been seen, and masses are sometimes present in the abdomen. Hepatomegaly and splenomegaly may also be seen.

## Infections in Animals

### Species Affected

*Coccidioides immitis* infection occurs in most species of domestic animals and many exotic animals. Animals of virtually any age may be susceptible. Coccidioidomycosis infections have been reported in horses, ruminants, pigs, nonhuman primates, cats, and dogs, which are the most significantly affected.

### Incubation Period

The incubation period in animals, as in humans, varies with the form of the disease. The incubation time for the primary form ranges from one to four weeks following exposure, while the incubation period for the disseminate form can be longer.

### Clinical Signs

As in humans, the disease varies from asymptomatic to disseminated and fatal, and clinical signs vary depending on the severity of infection and the species affected. Signs of the primary form of coccidioidomycosis include an elevated temperature (104–105°F), lethargy, loss of appetite, and a dry, harsh cough. The cough is pronounced and can be mistaken as bronchial, resulting in confusion with canine kennel cough in dogs.

While coccidioidomycosis is primarily a respiratory disease, the infection can disseminate to many tissues, especially in dogs. Infection of the bones is most common, resulting in lameness and/or limping. Other signs of disseminate infection in dogs include joint swelling, anorexia, chronic coughing, skin abscesses, fever, and intermittent diarrhea. Seizures and incoordination may also be seen.

In cats, dermatologic problems such as draining skin lesions, abscesses, and subcutaneous granulomatous masses are the most common presenting symptoms. Other signs of *C. immitis* infection in cats include fever, loss of appetite and weight loss; dyspnea, lameness and neurological abnormalities may also be seen.

In horses, abortion and osteomyelitis have resulted from placental infection, and pigs and ruminants typically have asymptomatic infections, with lesions limited to the lungs and thoracic lymph nodes.

## Communicability

Direct inhalation of fungal spores carried in dust or soil particles is the only established mode of infection. Coccidioidomycosis is not considered contagious from one animal to another, or from animal to man.

## Diagnostic Tests

In endemic areas, coccidioidomycosis should be suspected in dogs presenting with chronic bronchopulmonary disease, and when pulmonary nodules and enlarged lymph nodes are identified radiographically. *C. immitis* spores found free in the exudates draining from pyogranulomatous lesions can be helpful in diagnosis (ca5): the organisms may vary in size, appearing as 20–200µm spherules with a characteristically double-walled appearance, and diagnosis can be confirmed by demonstrating the spherules in tissues. Alternatively, detection of complement-fixing antibodies present in the serum established by agar gel immunodiffusion can also aid in diagnosis.

## Morbidity and Mortality

Due to current testing methods, very little information is available regarding the prevalence rate of *Coccidioides immitis* infections in animals, as infections may be asymptomatic and thus clinically undetectable. Mortality is not common in the primary form of the disease, but can be rather high in the disseminate form depending on the location and severity of the infection.

## Treatment and Vaccination

Treatment should be initiated immediately following diagnosis of coccidioidomycosis infection, and may vary depending upon the location of the infection and its severity. Long-term antifungal therapy is necessary, and should continue for at least one year for disseminated infections. Pharmaceutical treatment with antifungal agents has proven

effective in both man and animals. The likelihood of recovery from the primary form of coccidioidomycosis is quite high with therapy, while the chance of recovery from the disseminated form varies with the location and severity of infection; thus prognosis must be considered guarded. As there is no effective vaccine available, preventive measures include decreasing the animals' exposure to desert soil and dusty conditions as much as possible.

## Post Mortem Lesions

Gross lesions may be either disseminated or limited to the lungs, mediastinum, and thoracic lymph nodes. Lesions resulting from infection of *C. immitis* resemble those of tuberculosis, as they vary in size, are discrete and have a firm, grayish cut surface (ca1, ca2, ca3, ca4). Epithelioid and giant cells may be present in pyogranulomatous lesions, which may contain purulent exudates and fungal spores. Mineralized focal lesions may also be present.

## For More Information

Centers for Disease Control and Prevention (CDC)

[http://www.cdc.gov/ncidod/dbmd/diseaseinfo/coccidioidomycosis\\_t.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/coccidioidomycosis_t.htm)

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