

Review

Valley fever: danger lurking in a dust cloud

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Abstract

Coccidioides immitis and *Coccidioides posadasii* contribute to the development of Valley Fever. The ability of these fungal pathogens to evade the host immune system creates difficulty in recognition and treatment of this debilitating infection. In this review, we describe the current knowledge of Valley Fever and approaches to improve prevention, detection, and treatment.

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1. Introduction

Coccidioidomycosis is an infection caused by inhaling spores of the fungal species *Coccidioides immitis* or *Coccidioides posadasii*. The disease has commonly been termed “Valley Fever,” “San Joaquin Valley Fever,” “San Joaquin Fever,” “desert fever,” and “desert rheumatism” [1]. A high incidence of coccidioidomycosis has been reported in the southwestern United States, Central America, and South America [2,3]. The rise in cases has contributed to hospitalization costs totaling over \$2 billion for those afflicted with the illness, which include individuals with symptoms ranging from mild local infections to disseminated disease [4].

Although inhalation of *Coccidioides* is the most common mode of transmission, there are rare cases of transmission through transplanted organs or inoculation by penetration of

the skin by a sharp object containing the fungus [3,5]. While most infected individuals are asymptomatic, about 40% of individuals show flu-like symptoms, such as fever, cough, headache, skin rash, muscle aches, joint pain, and fatigue [1,3,6,7]. In most cases the immune system resolves the infection without the need for medical intervention. However, without proper diagnosis, disseminated disease may occur, leading to increased severity of symptoms. Laboratory diagnostic testing and clinical evaluation are the most effective measures for determining coccidioidomycosis. Early detection and antifungal drug treatments aid in slowing or inhibiting the development of disease and limit tissue damage, and may prevent morbidity [2]. In this review, we aim to provide a better understanding of coccidioidomycosis and to promote awareness of these pathogenic fungi.

2. Valley fever

2.1. Geographic distribution of coccidioidomycosis

Two types of coccidioidomycosis-causing fungi exist: *C. immitis* and *C. posadasii* [8]. *C. immitis* is mainly endemic to California and is often referred to as the “Californian” strain,

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while *C. posadasii* is distinguished as the “non-Californian” strain [8]. However, *C. immitis* has also been isolated from soil in Venezuela and Washington State, where several patients were suspected of contracting coccidioidomycosis [9,10].

There is a relatively low incidence rate of Valley Fever on a national scale in the United States and a variable status as a reportable disease across endemic regions [11,12]. *Coccidioides* fungi have been found in the Western Hemisphere, mostly in hot, arid areas between latitudes of 40° north and 40° south, including the southwestern United States, Mexico, and Central and South America (Fig. 1) [7,13,14]. Suspected sites of infection have been described as dry plains, hills, prairies, and tropical desert brush land [9]. These areas tend to have temperatures ranging from 5 °C to 45 °C, rainfall averaging between 125 and 500 mm, and altitudes between sea level and 800 m above sea level [9]. With differences in reporting over time and between regions, it is difficult to determine where the fungus was contracted, and which environments propagated the development of the disease [12].

2.2. Geographic distribution in Latin America

In 1892, one of the first described cases of coccidioidomycosis was observed in a 36-year-old Argentinian soldier by a medical intern, Alejandro Posadas, in Buenos Aires [11,15]. However, the more recent incidence and prevalence of coccidioidomycosis in Latin America is unclear [14]. Outside of the United States, other endemic regions include Mexico, Central America, and South America. South American countries that are confirmed to harbor the illness-causing fungus include Argentina, Colombia, Paraguay, and Venezuela,

though limited patient data exists to support these claims [9]. The regions of Bolivia, Ecuador, and Peru are also potential sites for harboring the fungus, but even less patient data is clearly documented for these regions.

2.3. Geographic distribution in North America

The highest rates of coccidioidomycosis cases in North America have been reported in Arizona and California [16]. The illness has also been reported in southern Nevada, southern Texas, Utah, New Mexico, and Washington [7,10,13,17]. Cases reported in Mexico generally tend to originate in the northern region [18]. However, the true incidence of the disease is not known, since coccidioidomycosis was not a reportable disease in Mexico until recently [18].

2.3.1. California

Many of the endemic cases of coccidioidomycosis in the United States are reported in California. The incidence of hospitalizations in California at 0.89 (95% CI 0.79–0.99)/100,000 persons/year likely under represents the extent of the disease in the San Joaquin Valley region, which contains only 10% of California's population [19]. This underrepresentation may be due to this region's population consisting of lower-income inhabitants, who are less likely to seek medical care except in severe cases of infection [19]. Initial reports of coccidioidomycosis in the United States were published in the San Joaquin Valley of California in 1939 [1,20,21]. In the last quarter century, dramatic increases in the reported incidence of Valley Fever in California have brought more public attention to the disease [13,19].

Since the fungus is spread through dust, an increase in the number of reported cases tends to occur during the harvesting season in endemic areas (Fig. 2). During World War II (WWII), several airfield training sites were built in the San Joaquin Valley. The dusty sites were suspected to have caused an 8–25% rate of new infections in those employed by the military, making it the most common cause of hospitalization at several Southwestern airbases [20]. A dust storm in 1977 in the San Joaquin Valley and an earthquake in 1994 in Northridge were also reported to have caused hundreds of cases of

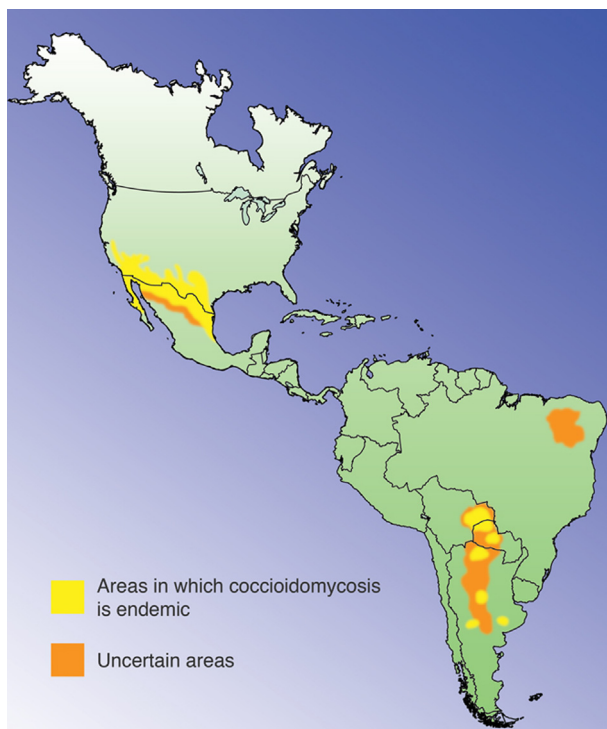


Fig. 1. Geographic distribution of valley fever across the Americas.



Fig. 2. A tractor disrupting soil and creating a dust cloud, which potentially could be spreading the fungal arthroconidia.

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