

*Review Article*

## ZOONOTIC ISSUES ON CRYPTOCOCCOSIS RELEVANT TO VETERINARY PUBLIC HEALTH AND VETERINARY MICROBIOLOGY: A REVIEW

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**Abstract:** Cryptococcus is a type of fungus that is found in soil usually in association with bird droppings. The major species of Cryptococcus that causes illness in human is *Cryptococcus neoformans*. Another species that may also cause disease in human is *Cryptococcus gattii*. Cryptococcosis is believed to be acquired by inhalation of the infectious propagule from the environment. Cryptococcosis is an opportunistic infection for AIDS and it is second most common AIDS illness in Africa.

**Keywords:** Cryptococcosis; Human; Public health.

### Introduction

The most common presentation of cryptococcosis is of *C. neoformans* infection in an immunocompromised person (such as persons living with AIDS). The *C. gattii* is being increasingly recognised as a pathogen in what is presumed to be immunocompetent hosts [1]. There is Evidence of zoonotic transmission of *Cryptococcus neoformans* from a pet cockatoo to an immunocompromised patient [2]. The indistinguishable patient and cockatoo isolates strongly suggest that the patient's infection resulted from exposure to aerosolized cockatoo excreta. *Cryptococcus neoformans* was isolated from the feces of the cockatoo. Isolates from

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excreta and from the patient were compared by using biochemical profiles, monoclonal antibody binding patterns, restriction fragment length polymorphism analysis, and karyotyping. The isolates from the patient and the cockatoo had identical biochemical profiles, the same monoclonal antibody immunofluorescence patterns, and indistinguishable patterns on restriction fragment length polymorphism analysis and karyotyping. In 2006 *Cryptococcus neoformans* and *Cryptococcus gattii* were isolated from the excreta of psittaciformes in a southern Brazilian zoological garden [3]. A Retrospective study was done from 1995-2006 on Cryptococcosis in domestic animals in Western Australia [4]. Multispecies outbreak of cryptococcosis was occurred in southern Vancouver Island, British Columbia in the year 2002 [5]. *Cryptococcus* spp. was thought to occur only as a yeast form until 1976 when Dr. Kyung Joo Kwon-Chung described the mycelial form (taking the form of branching, threadlike structures) of *C. neoformans* (termed *Filobasidiella neoformans*). *C. gattii* also has a mycelial form. The polysaccharide capsule covering the yeast forms renders *Cryptococcus* species resistant to human and animal immune defenses. The organ damage begins to occur when the slowly replicating fungi develop fungal masses (termed cryptococcomas) that start to compress or distort the involved organ (usually the lung or brain) and its vasculature. Some of these fungi can separate from a lung fungal mass or infected pulmonary nodule and then be carried by cells or swept into the bloodstream to then lodge and grow in other organs, especially the brain.

### **Cryptococcus infection in animals**

Cryptococcosis is also found in cats and dogs. It is the common fungal disease in cats, usually leading to chronic infection of the nose and sinuses, and skin ulcers. Cats may develop a bump over the bridge of the nose from local tissue inflammation. Cryptococcosis is most common in dogs and cats but cattle, sheep, goats, horses, wild animals, and birds can also be infected. Soil, fowl manure, and pigeon droppings are among the sources of infection [6, 7].

### **Risk Factors**

Risk factors for cryptococcosis caused by *C. neoformans* are inhalation of fungi that are associated with bird droppings, especially from pigeons. People who are immunocompromised, especially those with HIV/AIDS, are the most susceptible to acquire infection. Risk factors for cryptococcosis caused by *C. gattii* are different from *C. neoformans*. In general, *C. gattii* infections were mainly associated with tropical or semitropical climates around the world. However, *C. gattii* seems capable of inhabiting other areas. In 1999, there were cases of *C. gattii* noted in animals (cats, dogs, ferrets, marine

animals) and a few individuals in Vancouver Island, Canada. In 2006, an outbreak of cases (over 100) occurred with at least six deaths attributed to *C. gattii* on Vancouver Island. Since that time, other cases have been found in Washington and Oregon in the U.S. Currently, *C. gattii* has been sporadically isolated from plant debris, dust and air samples and usually near stands of trees or logging areas in the Pacific Northwest. Consequently, a risk factor occurs when people encounter airborne dust especially around logging areas.

### **Symptoms of Cryptococcosis**

Cryptococcal infection may cause illness, coughing and fever. Skin lesions may also occur. Another common form of cryptococcosis is central nervous system infection, such as meningoencephalitis. People with cryptococcal meningoencephalitis are usually immunocompromised. Other Symptoms may include fever, headache or change in mental status, pneumonia, meningitis, or involvement of bones and viscera organs.

### **Diagnosis**

Diagnosis is done primarily on the basis of symptom like fever, cough, headache etc. Detection of cryptococcal antigen (capsular material) by culture of CSF, sputum and urine provides definitive diagnosis [8]. Blood cultures may be examined in heavy infections blood cultures may be positive.

### **Prevention and control**

Environmental modifications may be considered in certain situations. Some sources suggest that eucalyptus mulch should be avoided with kiwis, as *C. gattii* caused fatal cryptococcosis in several of these birds. Environmental modification was also used at the Antwerp Zoo, when cryptococcosis occurred in an indoor exhibit, and *C. neoformans* var. *neoformans* was detected in a tree-trunk, tree-stumps, and decaying wood in that exhibit, but not in surrounding areas. In this case, the contaminated objects were removed and replaced. Cryptococcal mastitis in cattle is usually associated with treatment of the mammary gland for another condition. Care should be taken not to contaminate syringes, cannulas or antibiotic preparations. The teat ends should also be adequately prepared before treatment.

### **Treatment**

Intravenous injection of Amphotericin B combined with flucytosine by route is recommended. Where flucytosine is not available (i.e. in developing countries), fluconazole may be used with amphotericin [9]. The most cost-effective treatment is resource to be one week of amphotericin B with high dose of fluconazole [10].

## Summary

Distribution of *C. neoformans* is worldwide; it is present in soil contaminated with bird droppings, particularly those of pigeons. Patients with Hodgkin lymphoma, other lymphomas, or sarcoidosis and those taking long-term corticosteroid therapy are also at increased risk, as are recipients of a solid organ transplant. In immunocompromised patients, *Cryptococcus* may disseminate to many sites, commonly to the brain and meninges, and to the skin.

## References

- [1] Tripathi K, Mor V, Bairwa NK, Del Poeta M, Mohanty BK. (2012) Hydroxyurea treatment inhibits proliferation of *Cryptococcus neoformans* in mice.
- [2] Nosanchuk JD, Shoham S, Fries BC, Shapiro DS, Levitz SM, Casadevall A (2000). Evidence of zoonotic transmission of *Cryptococcus neoformans* from a pet cockatoo to an immunocompromised patient. *Ann Intern Med.* 1; 132 (3): 205-8.
- [3] Abegg MA, Cella FL, Faganello J, Valente P, Schrank A, Vainstein MH (2006). *Cryptococcus neoformans* and *Cryptococcus gattii* isolated from the excreta of psittaciformes in a southern Brazilian zoological garden. *Mycopathologia.*161 (2): 83-91.
- [4] McGill S, Malik R, Saul N, Beetson S, Secombe C, Robertson I, Irwin P (2009). Cryptococcosis in domestic animals in Western Australia: a retrospective study from 1995-2006. *Med Mycol.* 47 (6): 625-39.
- [5] Stephen C, Lester S, Black W, Fyfe M, Raverty (2002). Multispecies outbreak of cryptococcosis on southern Vancouver Island, British Columbia. *Can Vet J.* 43:792-4.
- [6] Deep Fungal Infections.
- [7] "Feline Cryptococcosis - WSAVA 2003 Congress - VIN".
- [8] Rhein, J; Boulware DR (2012). Prognosis and management of cryptococcal meningitis in patients with HIV infection". *Neurobehavioral HIV Medicine* 4: 45. doi:10.2147/NBHIV.S24748.
- [9] World Health Organization. Rapid advice: Diagnosis, prevention and management of cryptococcal disease in HIV-infected adults, adolescents, and children. Retrieved 1 August 2012.
- [10] Rajasingham, Radha; Rolfes, M.A.; Birkenkamp, K.E.; Meya, D.B.; Boulware, D.R. Jeremy, ed. Cryptococcal Meningitis Treatment Strategies in Resource-Limited Settings: A Cost-Effectiveness Analysis. *PLoS Medicine* 9 (9): e1001316. doi:10.1371/journal.pmed.1001316. PMC 3463510. PMID 23055838. Retrieved 26 September 2012.