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Review Article

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Another Perspective on Black Fungus Disease in Veterinary

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ABSTRACT

Mucormycosis, also known as black fungus is an opportunistic and serious fungal infection which is created by the order Mucorales. These fungi have a wide geographical distribution. The most important predisposing factors for this disease are hyperglycemia, metabolic acidosis, overuse of corticosteroids, neutropenia and blood malignancies. The disease occurs in several different forms; The most common of which is gastrointestinal and respiratory disorders in animals. Proper and timely diagnosis of the disease can play a key role in the prognosis, control and treatment of the disease. Since the disease can occur as a secondary infection in patients with COVID-19 who are being treated with corticosteroids to reduce inflammation, this study examines the status of black fungus disease in case reports of coronavirus in susceptible animals. Up to now, some cases of coronavirus and pneumoarthritis have been reported in animals.

Keywords: Black fungus, Corticosteroids, Coronavirus, Pneumoanthritis, Opportunistic, Serious

Introduction

Mucormycosis, previously called zygomycosis, is a serious fungal infection caused by fungus of the order Mucorales. Mucorales can affect different parts of body, including the sinuses, brain, lungs, and so on. Therefore, it can be prevalent in people who have recovered from COVID-19 or have it. Common symptoms associated with mucormycosis include swelling on one side of the face, fever, headache, nasal and sinus involvement, and black lesions on the bridge nasal or upper and inner mouth. Fungus that most often cause mucormycosis include Rhizopus species, Mucor species, Rhizomucor species, Syncephalastrum species, Cunnighamella Bertholletia species, Apophysomyces species, and Lichthemia species. Mucormycosis can come in many forms including gastrointestinal mucomycosis (most common in veterinary medicine), pulmonary mucomycosis (relative prevalence in veterinary medicine, and more common in people with cancer and people who have had organ transplants or stem cell transplants). Disseminated mucormycosis, rhinocerebral mucormycosis (higher prevalence in medicine and people with uncontrolled diabetes or kidney transplantation) and cutaneous mucormycosis. Chemotherapy long with corticosteroid therapy results in a neutropenia phase and provides the conditions for opportunistic pathogens, including the order Mucorales [3]. Coronavirus, which was reported in Wuhan, China in late December 2019 following a series of unexplained cases, is a serious public health concern. Immune system disorders and medical conditions such as diabetes mellitus and the widespread use of immunosuppressive agents and broad-spectrum antibiotics create the conditions conducive to secondary and potential infections, including mycosis [4].

Pathogenesis: The Mucorales enters the body through the release of small fungal spores, traumatic insemination and swallow [5]. When fungal spores invade the lungs or subcutaneous tissues, they are exposed to the body's first line of defense, mononuclear and multinuclear phagocytes. Healthy host phagocytes are able to kill Mucorales spores by producing oxidative metabolites and defense peptides [6]. Neutropenic patients with severe immunodeficiency or those with hyperglycemia and phagocytes disorders, are more at risk of mucormycosis [7].

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Another risk factor for mucormycosis is the high concentration of iron in the blood serum. Patients treated with deferoxamine show a high incidence of mucormycosis disease. This is because Mucorales uses this chelate as siderophore to get more iron [8]. Studies have shown that iron or deferoxamine prescription for infected animals with mycosis infections reduces their chances of survival [9]. The increased risk of mucormycosis in patients with ketoacidosis may also be due to the release of iron bound to plasma proteins [10]. If spores can escape from the host immune system and phagocytes, they can invade blood vessels and attach to endothelial cells to some extent. Rhizopus oryzae is even able to survive in conditions that the fungus is not viable [11].

Types of Mucormycosis in Veterinary

In ruminants, the disease occurs in the form of gastrointestinal lesions and inflammation of rumen, as well as lymphadenitis [12]. Types of mucormycosis have been studied as the case reports and include the following: Following antibiotic therapies, natural rumen microbial flora is destroyed and conditions for mucormycosis disease are provided in livestock [13]. Exposure to Mucorale fungus through contaminated food causes swelling of the intestinal lymph nodes, which is macroscopically indistinguishable from bovine tuberculosis granulomas [14]. In ruminants, gastrointestinal mucormycosis can occur in the other parts of gastrointestinal tract. Respiratory and systemic types are often reported due to invasion of fungus to the blood vessels and spread of hematogen to various organs [15]. In horses, lesions caused by mucormycosis have been reported in various organs, especially in the respiratory and gastrointestinal tract, and the disease may progress and become systemic [16]. Cases of cutaneous mucormycosis have also been reported in horses [18]. Few scattered reports of the occurrence of mucormycosis in poultry species are available; Respiratory and gastrointestinal disorders, in particular, have been reported frequently [19].

Treatment of Mucormycosis

Treatment of the disease requires rapid diagnosis and correction of predisposing factors, surgery and appropriate antifungal therapies. Unfortunately, diagnostic tools are so limited so that in some studies, 50% of cases are diagnosed only after death [20, 21, 22]. Delay in diagnosis indicates a poorer prognosis for the disease. In many cases of the disease, especially pulmonary and diffuse types, the surgery has been considered impossible in patients with neutropenia, however in some cases that surgery is possible, surgery with antifungal drugs is better than using antifungal drugs alone [24-29]. One of the reasons for the difficulty of treatment in the studies done, is the lack of large-scale clinical trials. The choice of the best antifungal drug depends on the results of studies on animal models and human experience. According to current data, the selective treatment of mucormycosis is liposomal amphotericin B, which also is less toxic [30-32].

Itraconazole is an unsuitable medicine according to the evidence of lack of appropriate treatment in patients with mycosis [33]. According to recent data, the use of Posaconazole is recommended in clinical cases that treatment with amphotericin has not been successful [34-36]. Cytokines such as gamma interferon, granulocytes, and macrophages have also been used to treat mucormycosis [37-38].

What Causes Black Fungus and Covid 19?

Coronavirus disease causes a state of immunosuppression and increases the risk of secondary infections such as mucormycosis. Coronavirus attributed to acute respiratory syndrome was declared as a global epidemic by WHO in March 2020 [39-42]. This pandemic with more than 162 million registered cases and more than 30 million deaths worldwide is still a public health concern [43]. As the incidence of the disease worsens around the world, many potential side effects of covid-19 including the susceptibility to secondary bacterial and fungal infections, increase [44-47]. Impaired immune response in covid-19 is associated with underlying diseases and concomitant medical conditions such as diabetes mellitus and the widespread use of immunosuppressive agents and broad-spectrum antibiotics [44]. The fungal infection most commonly studied in this study is mucormycosis and more likely to develop in the more advanced stages of covid-19 infection [48]. There is also a higher risk of mortality in the concurrency of covid-19 infection and mucormycosis [44].

Mucormycosis as previously mentioned in the pathogenesis of the disease, affect the patients with immunodeficiency, especially those with diabetes mellitus, long-term corticosteroid therapy, neutropenia transplant recipients and hematologic malignancies [44, 49, 50, 51]. On the other hand, it provides suitable conditions for mucormycosis due to the suppression of the immune system of people with covid-19 and also the prescription of corticosteroids to reduce pulmonary inflammation. Therefore, it is needed to increase awareness about mucormycosis among patients with covid-19 (since both conditions can lead to significant mortality).

Coronavirus in Veterinary

There are reports of coronavirus disease in the cat population worldwide named Feline coronavirus (FCoV). The only exceptions based on the absence of this disease in cats are the Falkland and the Galapagos Islands [52, 53].

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The virus causes Feline coronavirus enteric (FECV) disease in cats, which causes intestinal epithelial cells to become infected. In coronavirus enteritis, shortening of the intestinal villi, fusion or adhesion of the villi, and rounding of the villi and hyperplasia of the surrounding crypts can be seen on a microscopic level. Lieberkühn glands become necrotic, inflammation and swelling of the mesenteric lymph nodes next to the intestine are other symptoms of the disease [54]. The disease mainly occurs in the small intestine and can even be fatal in cats [54].

This intestinal infection can show few clinical symptoms and is usually chronic. In asymptomatic carriers, the virus is excreted in the feces and PCR tests of fecal samples are used to diagnose the disease.

Conclusion

Regarding to the research studies done by the others, it can be concluded that it can be expected the secondary infection of black fungus in cats with coronavirus enteritis as an emerging disease in medical science in the coming years due to the close relationship between human life and animals such as cats, also considering the formation of mucormycosis infection following infection with covid-19, which belongs to the family of coronaviruses.

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