

FUNGAL PNEUMONIA IN BLACK RHINOCEROS (*Diceros bicornis*)

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Abstract

Fungal pneumonia is an uncommon disease entity in domestic mammals, occurring principally in animals with severe primary disease or in animals that are immunocompromised. A survey of U.S. institutions holding black rhinoceros identified eight animals that had fungal respiratory disease at the time of death. The predominant fungus involved was *Aspergillus* spp. All black rhinoceros with fungal pneumonia had concurrent disease, including some with hemolytic anemia and/or mucocutaneous ulcers. Premortem diagnosis and treatment in the rhinoceros are challenging, making this a condition that may prove difficult to manage.

Resumen

La neumonía fúngica es una enfermedad poco común en mamíferos domésticos, ocurriendo principalmente en animales con una enfermedad primaria severa o en aquellos animales que están inmunodeprimidos. Un estudio de instituciones de Estados Unidos que tienen rinocerontes negros identificó ocho animales que tenían una enfermedad respiratoria fúngica en el momento de la muerte. El hongo predominantemente involucrado fue *Aspergillus* spp. Todos los animales con neumonía fúngica tenían otra enfermedad concurrente, incluyendo, en algunos casos, anemia hemolítica y/o úlceras mucocutáneas. El diagnóstico antemortem y el tratamiento en el rinoceronte representa un desafío, ya que esta condición puede ser difícil de manejar.

Introduction

Black rhinoceros in captivity are affected by a number of unusual diseases that have been previously described, including hemolytic anemia, mucocutaneous ulcers, and encephalomalacia.³ The etiologies of these diseases are not fully understood and at this time treatment is largely supportive, consisting of variable courses of antibiotics, corticosteroids, and nutritional supplements. A review of necropsy results from black rhinoceros showed that a seemingly large number of animals that had died or were euthanatized had evidence of invasive pulmonary fungal disease at necropsy. As fungal pneumonias are rare in domestic animals, including equids, a survey was sent to veterinarians at U.S. institutions holding black rhinoceros asking for information regarding occurrence of pulmonary fungal disease in their collections. Information was also requested regarding the use of corticosteroids in black rhinoceros at these institutions because of the potential immunosuppressive effects of these drugs and because of one previously reported case of a black rhinoceros that died of a systemic

mycotic infection after a long course of corticosteroid therapy.⁴

Results

Thirty surveys were sent out; at the time of writing 22 institutions had responded. Between the years 1980-1994 eight animals were reported to have had evidence of fungal respiratory disease at necropsy or on histopathology. During the same time period the North American Regional Studbook for black rhinoceros lists 57 animals greater than 1 yr of age that died, an incidence of 14%. Seven of the eight animals died between 1988-1994, a time period in which 28 black rhinoceros greater than 1 yr-old died, an incidence of 25%. All rhinoceros with fungal respiratory disease were affected with concurrent disease (anemia, mucocutaneous ulcers, tuberculosis). Corticosteroid use in the affected animals was sporadic, with two animals reported to have been on long-term steroid therapy immediately prior to death. Institutions reporting steroid use in black rhinoceros generally used corticosteroids as a single dose as an adjunct to anesthesia or as part of a short-term therapeutic regime. Most affected animals had been treated with broad spectrum antibiotics.

The most common findings on gross necropsy were multifocal firm nodules distributed throughout the lung lobes. Some nodules were foci of mineralization or fibrosis while others contained purulent debris. One animal had mats of fungi present in the trachea but no other reported gross evidence of fungal pneumonia. Microscopic lesions included extensive pulmonary necrosis with granulomatous inflammation, fibrosis, and mycotic emboli. Most fungi seen on histopathology were morphologically determined to be *Aspergillus* spp. These fungi (*Aspergillus* spp.) were also the organisms most frequently cultured; one animal had concurrent infections with *Mucor* spp. and *Aspergillus* spp.

Discussion

Systemic fungal infections in most animals are rare and fungal pneumonia is infrequently reported.⁶ One retrospective study examined necropsy results from 7,020 horses and confirmed 19 cases of fungal pneumonia, an incidence of 0.27%.⁵ In the above study some cases may have been missed on histopathologic examination as fungal pneumonias are often localized. However, there is still an apparently increased incidence of fungal pneumonia in black rhinoceros when compared to their most closely related domestic species. Possible explanations include increased environmental exposure to fungi, increased incidence of severe disease, and/or an inherent immunologic abnormality. The change in incidence from 14% to 25% between 1980-1994 and 1988-1994 is most likely due to improved institutional record keeping and more intensive postmortem diagnostic testing.

The majority of domestic mammals with fungal pneumonia have a serious primary disease such as enterocolitis, organ failure, neoplasia, or septicemia.⁶ Others are predisposed to infection by the use of corticosteroids or broad spectrum antibiotics. All the black rhinoceros identified in this survey had severe concurrent disease. Most had suffered bouts of mucocutaneous ulceration and many had had episodes of hemolytic anemia. Two animals were determined to be infected with *Mycobacterium* spp. The affected rhinoceros may have

been immunocompromised by their concurrent disease, however further studies are necessary to evaluate the black rhinoceros immune system and response to stress. The use of corticosteroids is not definitively related to the presence of fungal pneumonia but caution should still be exercised with the use of long-term or high-dose corticosteroid in sick rhinoceroses. Due to the alteration of bacterial flora, the use of broad spectrum antibiotics may also be an area of concern.

Premortem diagnosis of fungal pneumonia in black rhinoceros is difficult. *Aspergillus* spp. are ubiquitous in the environment and tracheobronchial lavage of normal horses can reveal the presence of fungal hyphae, either free or within mononuclear cells.¹ Radiography is not likely to be a useful option because of the size of the animals. Percutaneous lung biopsy may miss a site of infection due to the localized nature of fungal pneumonias. Serology has been shown to be of questionable value. Normal horses can have high titers against *Aspergillus* spp. due to environmental exposure, and animals that are immunosuppressed may not develop effective antibody titers.⁵

Systemic antifungal agents such as amphotericin B, ketoconazole, miconazole, or itraconazole have been considered for treatment. These agents have not been especially effective in humans with invasive pulmonary aspergillosis and the cost of long-term therapy with these drugs in black rhinoceros would be prohibitive.

At the present time, invasive fungal pulmonary disease appears to occur with unusually high frequency in black rhinoceros. The association with other severe diseases, the difficulty of premortem diagnosis, and the lack of effective and available therapy combine to create a clinical challenge. It is important to be aware of fungal pneumonia as a potential complicating factor when treating a sick black rhinoceros.

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