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OVERVIEW OF DISEASES OF THE AFRICAN RHINOCEROS

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ABSTRACT

With increasing threats from poaching and habitat fragmentation, African rhinoceros are being more intensively managed. Therefore, wildlife veterinarians need to be aware of diseases, diagnostic and therapeutic approaches that may be required to address health issues in these species. This presentation will provide an overview of some of the infectious and non-infectious diseases that have been reported in black and white rhinoceros. The information serves as a foundation for dealing with morbidity and mortality in African rhinoceros.

BACTERIAL DISEASES

Salmonellosis

This is a clinically important disease of rhinos, especially in confinement. Clinical syndromes vary; non-specific signs, anorexia, and lethargy; enteric disease with diarrhoea or bloody feces, colic; septicaemia, which may be fatal. Animals may recover and eliminate infection or they may become a carrier with inapparent shedding or intermittent clinical signs. In a study of black rhinos in a zoo, four of six animals were intermittent shedders with 2.4% of faecal samples culture positive.[1] Diagnosis is based on culture or PCR and serotyping. Isolation of Salmonella in an ill animal does NOT necessarily identify this as a cause of the clinical signs. Rhinos receiving antibiotics or immunocompromised by other disease or stress may shed bacteria. Intermittent shedding requires that samples are submitted for multiple cultures. Serotyping is based on cell wall and flagellar antigens, as well as biochemical characteristics; this is important epidemiologically. Treatment is primarily supportive, including fluid therapy, nutritional support, and anti-inflammatories. Antibiotics may be used but should be based on sensitivities since therapy may lead to a carrier state or antibiotic resistance. Generally antibiotics are used in more serious cases, young, or compromised animals. Predisposing factors for Salmonellosis include stressful events, such as transport or introductions, changes in feed resulting in gut flora imbalance, and concurrent disease. Preventive measures should minimize stress, provide good hygiene, and isolation of any animals that are shedding bacteria.

Tuberculosis (Mycobacteriosis)

This is a sporadic disease with significant clinical and regulatory consequences. It can be caused by either *M. bovis* or *M. tuberculosis* in rhinos. TB has been documented in white, black, greater one-horned, and Sumatran rhinos in captivity.[2] Anecdotal evidence suggests that browsing rhinos may be more susceptible. TB typically affects adults. Clinical signs vary – dyspnoea, coughing, nasal discharge, weight loss, weakness, or lethargy. Often animals are asymptomatic until disease is advanced, which may take months to years. At least 21 cases have been documented in African rhinos in zoos.[2] There have been four cases of documented *M. bovis* infection in black rhinos in South Africa.[3] Ante-mortem diagnosis is very difficult. Intradermal tuberculin testing is unreliable in rhinos. Tracheo-bronchial and gastric lavage samples can be used for mycobacterial culture. Serology appears promising and there are some commercial kits available (Chembio VetTB DPP). Research on experimental cytokine assays is underway. However, most diagnoses are made post-mortem.

Paratuberculosis (*M. avium* subsp. *paratuberculosis)*

This has been diagnosed in a single captive black rhino.[4] The animal had a 4 month history of diarrhea and weight loss. *M. avium* subsp. *paratuberculosis* was isolated from a faecal culture. The rhino was treated with anti-mycobacterial drugs and clinically resolved.

Leptospirosis
his is a zoonotic disease with worldwide distribution. Leptospirosis is caused by one of more than 250 pathogenic serovars of Leptospira. Rodents are the maintenance hosts. Antibodies has been reported in wild black and white rhinos in range countries.[5,6] Urine-contaminated feed is the source of infection. Transmission occurs through contact of the bacteria with mucous membranes or damaged skin. Leptospires can colonize the liver, kidneys, lungs, genital tract, and CNS. Clinical signs are variable; acute, systemic febrile disease with renal and/or hepatic damage has bene reported in black rhinos; uveitis, haemolytic anaemia, muscle pain, and abortion/stillbirth may also occur. Leptospirosis can be confirmed by identifying bacteria in blood, urine or tissues using immunofluorescence, PCR, or culture; however, it is more commonly diagnosed by elevated antibody titres using a microagglutination test. A 4-fold increase in serum samples taken 7-10 days apart or a single titer>1:800-1600 with compatible clinical signs are common criteria. Prevention includes good rodent control and vaccination using a polyvalent inactivated vaccine.

Clostridial diseases
***C. septicum* -** Malignant oedema occurs when there is bacterial contamination of wounds with local toxins causing severe oedema and necrosis. This disease may be a concern for rhinos if there is fighting, transport, or other wounds.
C. tetani - There are rare cases of tetanus in rhinos associated with spore-contaminated wounds. Clinical signs are similar to those in domestic animals. Equine tetanus vaccine has been used in captive rhinos.
C. novyi - There has been a fatal outbreak in white and black rhinos in semi-intensive management. Presented with peracute signs; typically, animals would collapse and progress rapidly to death. On post-mortem, hemorrhagic enterocolitis was evident. A vaccine has been developed.
C. perfringens (Enterotoxaemia) - This has resulted in 9 black rhino mortalities in Kenya[7], as well as morbidity in captive black and white rhinos. Clinical signs are often peracute with severe abdominal pain, laboured breathing, and death within hours. Severe necrotizing haemorrhagic enteritis is found at necropsy. Overgrowth of intestinal flora can be precipitated by change in diet, stress, and antibiotic treatment.

Diagnosis of clostridial diseases usually requires anaerobic culture of gastric or small intestinal contents, or tissue (including wounds). There are PCR assays for toxin genes. A mouse bioassay can also be used to detect toxins. Histopathology provides supporting evidence. Treatment requires intensive supportive care and potential administration of antitoxin if diagnosed early. Prevention is the key and there are multivalent vaccines that have been used in rhinos.

Streptococcal and Staphylococcal Infections
Beta haemolytic *Streptococcus* has been isolated from skin lesions and wounds in rhinos; this may progress to septicaemia and death. It has also been linked to vegetative endocarditis, myocardial degeneration, meningoencephalitis, and idiopathic haemorrhagic vasculopathy syndrome in captive black rhinos. Methicillin-resistant *Staphylococcus aureus* (MRSA) has been isolated from chronic wounds on captive rhino feet (zoonotic threat).

VIRAL DISEASES

Encephalomyocarditis virus (EMCV)
Typically a peracute disease with signs consistent with cardiac failure. Non-suppurative myocarditis and pulmonary oedema found post-mortem. Survivors may have cardiac damage. Exposure is measured by antibody titres, with diagnosis confirmed using virus culture, PCR, and/or histopathology.

Arboviral diseases
These are caused by a diverse group of vector-borne viruses (usually mosquitoes and midges). Viruses that have been reported in viruses include Shuni virus (Orthobunyavirus), Sindbis and Middelburg viruses (Alphaviruses), and West Nile virus (Flavivirus). Shuni, Sindbis and Middelburg viruses have been identified in rhinos with neurological signs; weakness, progressive paralysis and death within 24 hours of recumbency. West Nile virus infection has been suspected in zoo rhinos, causing nonspecific signs such as lethargy. Rhinos in endemic areas commonly develop antibody titres (up to 1:640). Antibodies to other arboviruses have been found in rhinos, but not associated with disease; Wesselbron, African Horse Sickness, Bluetongue, and Rift Valley Fever (high

seroprevalence in some areas).[6,8] Diagnosis is usually by serological tests (ELISA, plaque reduction neutralization test, etc.) Other available tests include PCR and immunohistochemistry for some viruses. Management requires good vector control and consideration of vaccination in captive rhino (for example WNV).

FUNGAL DISEASE

Aspergillosis

Fungal pneumonia caused by *Aspergillus* sp. has been identified primarily in captive black rhinos.[9] These cases were usually associated with immunosuppressive diseases or therapy (ex. steroid administration). All rhinos had concurrent disease such as anaemia, mucocutaneous ulcers, or TB. Diagnosis is based on Aspergillosis serology, fungal culture, and/or histopathology. Treatment is usually unsuccessful (eg. itraconazole).

PROTOZOAL AND PARASITIC DISEASES

Tick-borne protozoal diseases

Babesia bicornis (piroplasm) has been reported to cause mortalities in black rhinos in Tanzania and RSA.[10] However, the organism has also been found in healthy animals. Disease may be precipitated by stress. *Theileria bicornis* (piroplasm) has also been found in black and white rhinos in Kenya and RSA, but has not been associated with disease. *Ehrlichia ruminantium* may infect black and white rhinos, based on the presence of antibodies to heartwater found in animals in Zimbabwe.

Neosporosis (*N. caninum*)

N. caninum is a coccidian parasite of domestic dogs found worldwide. Transmission is faecal-oral or transplacental. Abortion, acute death (myocarditis) have been seen in white rhinos, and may also cause neurological signs.[11,12] Diagnosis is based on serological tests (ELISA, IFAT, agglutination), immunohistochemistry, or PCR.

Trypanosomiasis (*T. vivax, T. congolense, T. simiae, T. godfreyi, T. evansi*)

Mortalities have been associated with translocation of black and white rhinos from fly-free to tsetse areas due to Trypanosomiasis.[13] Animals exhibit loss of condition, weakness, and death associated with anaemia, leukopenia, thrombocytopenia, and hypoproteinaemia. There has been a fatal outbreak of *T. evansi* in Sumatran rhinos in a Malaysian sanctuary.[14] Acquired immunity results in asymptomatic infection until an individual is subjected to stress. Diagnosis is based on blood smear, PCR, IHC, and ELISA. Management requires tsetse control and possibly strategic use of trypanocides (diminazene aceturate).

Filarial skin disease

Stephanofilaria dinniki is a subcutaneous parasite of black rhinos that usually results in self-limiting skin disease. Clinical manifestation may be associated with environmental conditions and stress. There has been an outbreak of skin lesions in black and white rhinos in Meru National Park.[15] Although they were unable to identify the parasites, lesions responded to treatment with ivermectin, amoxicillin and debridement.

TOXIC, METABOLIC/NUTRITIONAL, NONINFECTIOUS AND IDIOPATHIC DISEASES

Cyanobacteria intoxication

Blue-green algae (*Microcystis* spp., others) release biotoxins that are hepato- and neurotoxic. Ingestion while drinking results in death of rhinos and other species due to liver and respiratory failure.[16] On necropsy, the liver is enlarged and friable, with widespread areas of haemorrhage.

Iron Overload Disorder (IOD)

Previously known as iron storage disease, this is an important disease of captive black rhinos.[17,18] It has also been observed in recently captured black rhinos placed in bomas (Zimbabwe). Unknown etiology, but suspected to be related to captive diets. Usually associated with nonspecific clinical signs. Diagnosis is based on iron profiles (TIBC, ferritin), and histopathology. Treatment can include therapeutic phlebotomy and or chelation therapy.

Chronic renal disease

This is an emerging problem in rhinos (both black and white).[19] Based on necropsies of captive black rhinos performed between 2007 and 2012, 74% of animals had significant renal disease. Unfortunately, there are no obvious clinicopathological changes that provide a clear diagnosis. Progression usually to renal failure with development of anaemia, lethargy, decreased appetite, and loss of condition. Aetiology is unknown but may be related to diets high in protein (Lucerne, alfalfa) and chronic nonspecific inflammation. Diagnosis is usually made post-mortem. Treatment is supportive.

SUMMARY

Infectious, metabolic, nutritional, immune-mediated, toxic, traumatic, and idiopathic diseases may affect white and black rhinos. Differential diagnostic list in ill/dead rhinos should include common and uncommon diseases of domestic animals. Further studies are required to investigate epidemiology of diseases in these species.

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