

vaccine that gave 80 to 100% protection in cattle. Since, in the present investigation, the average neutralization indices against all three serotypes of the virus was more than 1.5, it is anticipated that the vaccine would, perhaps, be able to induce an adequate level of protective immunity in this species against the disease.

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Salmonellosis in Adult Indian Rhinoceroses (*Rhinoceroses unicornis*)

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Introduction

Zoo animals are known to suffer from salmonella infection in many parts of the world. Literature pertaining to the incidence of salmonellosis in rhinoceroses in India is scant. As such, there is no record of the infection due to *S. typhimurium* and *S. enteritidis* in rhinoceroses causing fatalities. This is a report on the mortality of three adult Indian rhinoceroses stationed at Nehru Zoological Park, Hyderabad, Anahra Pradesh State, as a result of salmonella infection.

Clinical History. In August, 1983, three adult Indian rhinoceroses, two males aged 12 and 25 years and one female aged 20 years, died after an illness of 8-10 days duration, within a span of 15 days, one after the other.

Early clinical signs noticed were dragging of both hind limbs, shivering of body and forelimbs with intermittent convulsions, and recumbency which lasted till death. Grinding of the teeth and increased rate of respiration were observed. Petechiae of the visible mucous membranes, mucoïd lacrimation and nasal discharges was noticed. A few days before death, the animals became weak as a result of diarrhea and dehydration. On the day of death, hematuria and yellowish discoloration of the body coat was observed.

Treatment included tetracycline, antibiotics, vitamins, corticosteroids, electrolytes and saline, which were given both orally and parenterally. Despite continued therapy, the animals died without showing any response to treatment.

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Necropsy Findings. Extensive submucosal and subserosal petechial hemorrhages were noticed. The heart and spleen were congested and edematous. The liver was enlarged and congested. Hemorrhagic enteritis was seen and the entire lumen of the small intestine was packed with a heavy infestation of tapeworms. Mesenteric lymph nodes were swollen, edematous and congested. All three rhinoceroses revealed the same type of lesions except one, the lungs of which showed multiple abscesses of varying sizes from 1-6 cm, with considerable amounts of blood tinged exudation from cut surfaces. In the other two, the lungs were consolidated with pleural adhesions showing pneumonic lesions. In the female, amphistomes were observed in the stomach. The uterus was gravid with an 8-month fetus. In general, all the organs were severely congested indicating septicemic infection.

Histopathology Examination. In the intestines, congestion of blood vessels in the lamina propria and submucosa was seen. At some foci, there were hemorrhages in the lamina propria and a few of the macrophages were laden with golden yellow hemosiderin pigment. Infiltrations of mononuclear cells, mainly lymphocytes and macrophages were evident.

In the heart, mild congestion of blood vessels was observed in the musculature, subepicardium and between myofibrils. There was severe congestion of blood vessels in the interstitial spaces of the kidneys. The lungs of one rhinoceros had granulomatous foci with Langhan's giant cells and acid fast organisms. The liver and spleen were congested.

Laboratory Investigations. Lung abscesses of the male rhinoceros contained acid fast organisms morphologically indistinguishable from *Mycobacterium tuberculosis* on Ziehl-Neelsen's method of staining.

The tapeworms which were found fully packed and interwoven throughout the lumen of the small intestines of all three animals were identified as *Anaplocephala* species.

Amphistomes found in the stomach of the female rhinoceros were identified as *Cotylophoron* species.

Heart blood, liver and intestinal contents of the three animals were subjected to detailed bacteriological examination. Based on biochemical and sugar fermentation tests, the organisms isolated were identified as *Salmonella* species¹. These isolates, sent to National Salmonella and Escherichia Centre, Kasauli, were identified as *S. typhimurium* and *S. enteritidis*, with antigenic formulae 1,4,5,12:i:1,2 and 1,9,12: g,m, respectively.

In vitro, antibiotic sensitivity tests for the isolates were conducted by conventional paper disc diffusion method as described by Cruickshank², using discs supplied by Span Diagnostics, Surat. *S. typhimurium* and *S. enteritidis*, were both found to be sensitive to gentamicin, neomycin followed by furadantin, and Chloramphenicol. Complete resistance was encountered with oxytetracycline, chlorotetracycline, streptomycin, ampicillin, erythromycin and penicillin.

Materials from all three animals sent to the Indian Veterinary Research Institute, Mukteswar, for investigation of probable viral infections, were found to be negative for viral agents.

Discussion. From the available literature and statistical data, enteric infections in man and animals are most frequently caused by infection with the salmonella group of organisms. There is not an abundance of literature on salmonellosis in zoo animals and rhinoceroses. Salmonellae have been reported in young rhinoceroses⁴, although not as the cause of fatalities. Schmidt and Hartfiel³ attributed the death of an infant rhinoceros born at San Antonio zoo to acute salmonellosis, though no salmonella organisms were isolated.

In the present investigation, *S. typhimurium* and *S. enteritidis* were isolated from all three adult rhinoceroses which died showing septicemic lesions. One male rhinoceros had extensive localised tuberculous lesions in the lungs, and a pregnant female had

amphistomes (*Cotylophoron* sp) in the stomach. Further, all three animals had heavy infestation of tapeworms (*Anaplocephala* sp.). The multiplicity and chronicity of these disease entities may probably have lowered the vitality of the animals, allowing the salmonella organisms present in the intestines to proliferate causing mortality among these animals.

The rhinoceroses were located in an area with a pond of stagnant water. There is a possibility for rodents, mongoose and bandicoots, which act as carriers of salmonella organisms, to move freely in the premises. Human infection may pose a threat to the captive animals. Though the source of the salmonella infection was not established in this study, the authors are of the opinion that poor environmental sanitation and other factors might have contributed to the deaths of the three adult Indian rhinoceroses from salmonella infection.

Summary

Mortality of three adult Indian rhinoceroses,

S. typhimurium and *S. enteritidis* infection is reported.

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Age-Related Changes in the Blood Count of the Scimitar-Horned Oryx (*Oryx tao*)

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Introduction

A knowledge of physiological variations in normal hematological values is of considerable importance when blood tests are to be used for health monitoring or for diagnostic purposes. Age related changes in the blood count are common in mammals, but these

have been fully documented in few wild species. Normal hematological data are available for the scimitar-horned oryx (*Oryx tao*), the Arabian oryx (*O. leucoryx*) and the gemsbock (*O. gazella*)^{3,7} and, although these data have not yet been analyzed for the possible effects of age, comparison with published values on neonatal Arabian oryx¹ indicate that age-related differences occur in these species.

Over the past five years we have studied a number of scimitar-horned oryx from the collections at Regents' Park, Whipsnade Park and Marwell Zoological Park. This paper describes the findings in clinically normal individuals from birth to maturity.

Materials and Methods

Scimitar-horned oryx less than seven

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