Black rhino necropsy evaluation

causes of disease and death

Katharina Radeke-Auer, M. Clauss, Julia Stagegaard,
Linda G.R. Bruins-Van Sonsbeek, Javier López

EAZA Rhino TAG 2023

University of Zurich[UZH]

Clinic
of Zoo Animals, Exotic Pets and Wildlife

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Retrospective pathology review of captive black rhinoceros *Diceros bicornis* in the EAZA Ex-situ Programme (1995-2022)

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[1]*Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich, Winterthurerstr. 260, 8057 Zurich, Switzerland*
[2]*Ree Park Safari, Stubbe Søvej 15, 8400 Ebeltoft, Denmark*
[3]*Rotterdam Zoo, PO Box 352, 3000 AM Rotterdam, The Netherlands,*
[4]*Chester Zoo, The North of England Zoological Society, Caughall Rd, Chester, CH2 1LH, UK*

Correspondence: Marcus Clauss, email; mclauss@vetclinics.uzh.ch

Keywords: black rhinoceros, *Diceros bicornis*, disease, gastric ulcer, iron overload disorder, tooth wear

Article history:
Received: 13 Feb 2023
Accepted: 18 Apr 2023
Published online: 30 Apr 2023

Abstract

The husbandry of black rhinoceros *Diceros bicornis* is challenging due to a number of peculiar diseases affecting this species. Causes of mortality and morbidity were evaluated from 67 necropsy reports of black rhinos deceased in the EAZA Ex-situ Programme (EEP) in 1995–2022, and the prevalence of specific diseases were compared with previous surveys in the literature. Whereas some problems described as typical, such as haemolytic anaemia, aspergillosis or specific skin diseases presented at low prevalence, signs of iron overload disorder (IOD) were close to ubiquitous across animals, and skin disease, excessive tooth wear (often linked to impaction) and gastric ulceration were particularly prevalent. While this evaluation cannot add to understanding of the aetiology of these conditions, it emphasises the need to further investigate IOD and other diseases (which will require access to routine blood samples of both healthy and diseased animals facilitated by medical training). The findings also recommend further investigation of measures to reduce stress, possibly including that triggered by conspecifics as well as humans. Species-adequate nutrition still requires proactive approaches in providing dicot-based forages without resorting to monocot (grass) products.

Introduction

According to the International Union for Conservation of Nature (IUCN), the black rhinoceros *Diceros bicornis* is Critically Endangered because of habitat loss and, most importantly, due to poaching (Emslie and Brooks 1999; IUCN 2021). A dramatic 96% decline in wild populations has resulted in numbers falling from 100,000 in 1960 to about 2,400 individuals in 1992. In spite of an increase to about 5,000 individuals in 2012 (Emslie 2013), the most recent population estimates are about 3,100 individuals of a population reported as 'increasing' (IUCN 2021), which reflects the volatile state of the species in the past decade. The black rhino therefore falls under the group of megafauna for which ex-situ conservation efforts have been proposed as one crucial component for conservation of the species (Farhadinia et al. 2020).

The ex-situ management of black rhinos is challenging for several reasons. Black rhinos are browsers, which makes it logistically demanding to replicate their natural diet in an ex-situ setting (Clauss and Hatt 2006). They have a solitary lifestyle (Mukinya 1973) and a comparatively aggressive nature, which means that they cannot be kept in groups or in mixed species exhibits (Pilgrim and Biddle 2020). Recently, a low reproductive rate of the ex-situ population has raised concern (Edwards et al. 2015). Although quantitative assessments are difficult, black rhinos may be more susceptible to stress than white

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n = 67 reports 1995-2022

- age-specific developments

- historic developments

- relationships with iron overload disorder

Age dependence

Age class	Infant 0-1 yr	Subadult 1-5 yr	Young adult 6-17 yr	Adult 18-32 yr	Post-reprod. 33+ years
n (male.female.unknown)	15 (5.9.1)	4 (1.3.0)	14 (6.8.0)	21 (8.13.0)	13 (3/10/0)

Age class	Infant 0-1 yr	Subadult 1-5 yr	Young adult 6-17 yr	Adult 18-32 yr	Post-reprod. 33+ years
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Stomach ulceration	-	1 (25%)	6 (43%)	9 (43%)	4 (31%)

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Iron overload disorder					
(of all animals)	1 (7%)	3 (75%)	10 (71%)	18 (86%)	8 (62%)
#animals tested	9	4	10	18	8
#(of all *tested* animals)	3 (33%)	3 (75%)	10 (100%)	18 (100%)	8 (100%)

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Black rhino teeth

A

B

C

Historical developments

Pathogen	Sample	n	Prevalence
Mycobacterium	cases/series[3]		
	studbook, 1970-1990[1]	151	5%
	SSP dermatitis cases, 1989-1994[2]	34	6%
	this study, 1995-2022	67	0%

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Disease	Sample	n	Prevalence
Dermatitis / Dermopathy	studbook, 1970-1990[1]	151	3%
	SSP survey, 1930-2001[2]	296	19%
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	this study, 1995-2022	67	39%
Pododermatitis / Laminitis	cases/series[4]		
	studbook, 1970-1990[1]	151	0%
	this study, 1995-2022	67	12%
Glomerulopathy / Nephritis	cases/series[5]		
	studbook, 1970-1990[1]	151	3%
	this study, 1995-2022	67	34%
Neoplasia	cases/series[6]		
	studbook, 1970-1990[1]	151	3%
	this study, 1995-2022	67	6%
Dental issues (wear, calculus, loss)	cases/series[7]		
	studbook, 1970-1990[1]	151	0%
	SSP survey, 1930-2001[2]	296	7%
	this study, 1995-2022	67	30%

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Received: 9 June 2023 | Revised: 30 July 2023 | Accepted: 25 August 2023

DOI: 10.1002/zoo.21802

COMMENTARY

ZOOBIOLOGY

Putting zoo animal cancer into perspective

Marcus Clauss[1] | Dennis W. H. Müller[2]

Disease	Sample	n	Prevalence
Hemolytic anaemia	cases/series[4]		
	SSP survey, 1972-1982[5]	29	48%
	studbook, 1970-1990[1]	151	8%
	SSP dermatitis cases, 1989-1994[6]	34	9%
	this study, 1995-2022	67	4%

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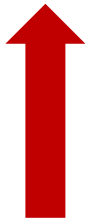
Hemolytic	cases/series[4]		
anaemia	SSP survey, 1972-1982[5]	29	48%
	studbook, 1970-1990[1]	151	8%
	SSP dermatitis cases, 1989-1994[6]	34	9%
	this study, 1995-2022	67	4%
Iron overload	cases/series[11]		
disorder	SSP survey, 1930-2001[10]	296	16%
	this study, 1995-2022	67	60%
		44*	91%



Relationship with iron overload disorder

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Disease	Sample	n	Prevalence	IOD comorbidity (% of all tested)
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Conclusions

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Changes in the disease spectrum => move towards older animals: need to adress specific issues

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Some 'typical' diseases are apparently 'under control' – but skin diseases need special attention.

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Some 'typical' diseases are apparently 'under control' – but skin diseases need special attention.

Iron overload disorder is just everywhere: keep monitoring, consider stress (also with respect to gastric ulcer prevalence).

thank you for your attention