
PULMONARY GAS EXCHANGE AND ACID-BASE STATUS IN IMMOBILIZED BLACK RHINOCEROS (*Diceros bicornis*) AND WHITE RHINOCEROS (*Ceratotherium simum*) IN ZIMBABWE

Åsa Fahlman, DVM,^{1*} Chris Foggin, BVSc, DPhil, MRCVS,² and Görel Nyman, DVM, PhD, Dipl ECVA¹

¹Anesthesiology and Intensive Care Unit, Department of Large Animal Clinical Sciences, Faculty of Veterinary Medicine and Animal Science, Swedish University of Agricultural Sciences, P.O. Box 7018, S-750 07 Uppsala, Sweden; ²Wildlife Veterinary Unit, Department of Veterinary Services, Private Bag BW 6238, Harare, Zimbabwe

Abstract

Few studies have described arterial blood gas values in black rhinoceros¹ (*Diceros bicornis*) and white rhinoceros (*Ceratotherium simum*),²⁻⁵ and only one involved free-ranging animals.³ The aim of this study was to evaluate pulmonary gas exchange and acid-base status in immobilized black and white rhinoceros. Arterial blood samples were collected from 13 black and four white rhinoceros during 19 immobilization procedures, which included ear notching, snare removal, and translocation. Sixteen free-ranging rhinoceros were darted from a helicopter with a combination of an opioid, an alpha₂-agonist, azaperone, and hyaluronidase (Table 1). Once immobilized, nalorphine was given i.v. to improve respiration by partial reversal of the opioid effect. One boma-held black rhinoceros (subadult) was immobilized three times due to a snare injury, using 1.7 mg etorphine and 30-45 mg azaperone. Pulse oximetry derived oxyhemoglobin saturation (SpO₂), rectal temperature, heart and respiratory rates were recorded every 10 min. Thirty-nine samples were taken from auricular arteries 6-76 min after darting, and processed in the field using an i-STAT Portable Clinical Analyzer (Abbott Scandinavia AB, Box 509, SE-169 29 Solna, Sweden). The samples were analyzed for pH, PaCO₂, PaO₂, base excess, HCO₃⁻, SaO₂, and lactate. Supplemental oxygen (10 L/min) was provided through a nasal tube to one black and one white rhinoceros.

All free-ranging rhinoceros developed acidemia (pH 7.13-7.34), hypercapnia (PaCO₂ 48-77 mm Hg) and hypoxemia (PaO₂ 40-79 mm Hg). Least physiologic changes were observed in the boma-held black rhinoceros. Metabolic acidosis was present in all free-ranging rhinoceros, and initially high lactic acid levels decreased during the course of immobilization. In 28 out of 35 readings SaO₂ were lower than SpO₂. Oxygen supplementation markedly improved oxygenation (PaO₂ 108-194 mm Hg). In conclusion, hypercapnia and hypoxemia, indicative of impaired pulmonary gas exchange, and lactic acidemia were evident in both species of free-ranging rhinoceros with the capture method and drug combinations used in this study.

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Table 1. Age, sex, and range of drug doses used in two species of free-ranging rhinoceros.

Species	Black rhinoceros			White rhinoceros		
	Age	adult	subadult	calf	subadult	calf
Number of animals and sex		7M ^a , 2F ^b	1M, 1F	1M	2M, 1F	1M
Etorphine ^c	(mg) n ^d =14	3.2-4.3	2.8	1.5	2.8-3.5	2.0
A3080 ^e	(mg) n = 2	3.0	2.0	-	-	-
Detomidine ^f	(mg) n = 8	3.5-4.5	2.5	1.0	3.5-4.5	-
Xylazine ^g	(mg) n = 8	20-45	20	-	-	22
Azaperone ^h	(mg) n = 16	70-90	40-50	20	50-60	35
Hyaluronidase ⁱ	(IU) n = 16	2000-8000	4000-5000	4000	4000	1250
Nalorphine ^j	(mg) n = 16	1.0-8.0	2.0-2.5	3.0	20-26	6.0

^aMale.

^bFemale.

^cM99[®], 9.8 mg/ml, Novartis South Africa (Pty) Ltd., 72/74 Steel Rd, Spartan, Kempton Park 1620, South Africa.

^dNumber of immobilization procedures the drug was used in.

^eA3080, 10 mg/ml, Wildlife Pharmaceuticals Inc., Fort Collins, Colorado 80524, USA.

^fDomosedan[®], 10 mg/ml, Novartis South Africa (Pty) Ltd.

^gRompun[®], 100 mg/ml, Bayer, Leverkusen, Germany.

^hStresnil[®], 40 mg/ml, Janssen Animal Health, P O Box 651 Halfway House 1685, South Africa.

ⁱHyaluronidase, lyophilized powder, 5000 IU/vial, Kyron Laboratories (Pty) Ltd., 29 Barney Road, Benrose 2094, South Africa.

^jNalorphine[®], 20 mg/ml, Kyron Laboratories (Pty) Ltd.