from Dvur Kralové Zoo (Director: Dr. Ing. P. S U K)

BRIEF ANALYSIS OF VETERINARY CARE OF BLACK RHINOCEROS (DICEROS BICORNIS) AT DVŮR KRÁLOVÉ ZOO

By J. V á h a l á

The number of large animals has dropped very rapidly in nature in 20th century. Numerical decline of black rhinoceros has been more evident, over the last twenty years. In 1970, its number was estimated about 65,000 animals and in 1987 less than 3,800. In the same year, 180 animals were registered in captivity (CUMMING, 1987; KLÖS, 1987). If this decline will continue, black rhino as a species has minimal chance to survive in the wild. It already disappeared from some localities in Africa (Ethiopia, Somalia, Mosambique, Angola), and 73 percent of the population live in a relatively small area (Republic of South Africa, Namibia, Zimbabwe) (CUMMING, 1987).

This species is still kept with difficulties in captivity. Nutrition and health condition play a very important role in breeding. Many authors have generally dealt with health problems of rhinoceroses, presenting latest knowledges of veterinary problems of all rhino species (SILBERMAN and FULTON, 1979; STEHLÍK, 1979; JONES, 1979; LANG, 1982; FOWLER, 1986; GÜLTENBOTH, 1986). KOCK (1987) dealt especially with health problems of black rhino in the UK, and MARUSKA et al. (1986) summarized breeding experiences from many world zoos.

History of black rhinos at Dvůr Králové Zoo

Fourteen animals (5,8 directly from Kenya and 1,0 from the USA) were transferred to Dvůr Králové Zoo (Table 1). Throughout the history of breeding, 22 animals (10,12) were kept at the Zoo. Table 2 shows complete data by KLÖS (1987). At present our Zoo keeps 0,2 animals from Kenya, 1,0 from the USA, and 3,4 born here.

Housing

The animals are separately accommodated in boxes, 5 x 5 m in diameter, with watering-places. Food is given right to the ground. No strawing is used. The inside temperature is between 17°C and 23°C during winter. The outside enclosure is 50 x 30 m in diameter, with one third being concrete ground and two thirds hard gravel. Rhinos enter here single or female with her young, pair or two females or two females with one male. In winter, animals spend 30 minutes to three hours in the outside enclosure, depending on outdoor temperature. In the summer season, they can stay there even overnight.

Nutrition

The diet is balanced through the whole year with only minimal differences between summer and winter. It is based on hay ad libitum of which adult rhinos accept 7 - 17 kg per day, 2 kg of crushed oat, 1 kg of ZOO I pellets (for composition see ŠPÁLA et al., 1987) and 1 kg of alfalfa meat pellets. An evaluation of digestibility of this diet is prepared for press (ŠPÁLA and HRADECKÝ, in press). There has been a change in composition of the grain ration since September 1989. Animals receive only 4.3 kg of ZOO C pellets (commercial pellets). In the winter season, 2 - 5 kg of carrots are added to the diet, while in the summer season the hay ration is supplemented by a small volume of fresh grass and 1 - 2 pieces of tree branches per animal. Iron in the form of ferrum fumaricum (Farmaferr, Spofa), 70 g per adult animal, is added to the diet all the year round. The diet for females in lactation is enriched by 3.3 kg/die of dry milk powder.

Preventive care

Some authors described vaccination against leptospirosis, tetanus, encephalitis, anthrax, and elephant-pox (OTT et al., 1982; MARUSKA et al., 1986). In our Zoo, we have never performed any special injectable vaccination on our rhinos. Preventive medicine is aimed at serological screening of infectious diseases (Table 3) and application of vitamin and mineral supplements. Daily applications were retinolum palmiticum (930 000 I.U.) and ergocalciferolum (450 000 I.U.) (Combinal AD2 forte, Spofa) per animal, once on February, and tocoferolum aceticum (300 mg) (Combinal E forte, Spofa) per animal. So, together with the amount in the grain ration, adult animals received 450 mg and, since September 1989, 950 mg of tocoferolum aceticum every day. Iron is given in the form of ferrum fumaricum (see nutrition).

Parasite control

SILBERMAN and FULTON (1979), JONES (1979), LANG (1982) gave a survey of parasite occurrence in both wild and captive rhinoceroses. In agreement with these authors and conclusions by MARUSKA et al. (1986), we can say that parasites do not cause any problem in animals kept for extended periods of time or born in captivity. We perform regular annual coprological examinations on all rhinos. Only slight invasion of coccidiosis without damage to health was once diagnosed, and a sporadic number of tapeworms of Anoplocephala magna was found in one dead animal. We have never found any ectoparasitic species in our animals two years after their arrival or in animals born in captivity.

Reproduction

The first breeding of black rhinoceros occurred in Brookfield Zoo, Chicago, 1941 (LANG, 1982). Since that time, black rhino has bred in many ZOOS, and many authors described their experience in reproduction (KOLB, 1958; YAMAMOTO, 1967; KRISHNE COWDA, 1967; HAYS, 1967; GREED, 1967; DIETTRICH, 1967; HALL-MARTIN and PENZHORN, 1977; JONES, 1979; LANG, 1982; MARUSKA et al., 1986).

Eight successful parturitions have occurred, and the following data have been established from our collection:

- Birth weight (n=3) 28 - 35 kg;
- Sexual maturity in 4 - 5 years in both sexes, but 6 years seem to be necessary for successful pregnancy;
- Body maturity at the age of 6 years, when animals weigh 700 - 1200 kg;
- Reproductive ability in connection with longevity of 30 - 35 - 45 years, as stated by CRANDALL (1964), GODDARD (1970), HALL-MARTIN and PENZHORN (1977), MARUSKA et al. (1986), seems to be optimal at the age of ca. 25 years. Our oldest female gave birth at the age of 20 years and successfully nurses its young;
- Oestrus lasting about 12 - 24 hours, but copulation occurs 1 - 6 days after first sign of oestrus;
- Oestric cycle is very irregular; we observed duration of 21 - 30 days in 13 cases, but in several cases more than 40 days;
- Gestation in our 7 cases lasted 453.4 days on average (439 - 462 days).

The anatomy of male copulative organs was described by OTTOW (1955), but there were only few comments about female organs. We have not found any other work on this theme. YOUNG (1967) and PLATZ et al. (1979) referred to sperm collection and examination, using manual massage or electro-ejaculation.

We tried to examine the reproductive organs of one adult non-cycling and non-breeding female which had originated from Kenya. Vaginal and rectal inspection was done under general anesthesia. Though body diameters were smaller than those of white rhino, this method of examination was not suitable in either case. We were able to penetrate the

Table 2: Black rhino pedigree

Std-No	Sex	Name	Birth	Death	Sire/Dam	Location	Since
169	M	DVU 01 Lord	69		wild/wild	Dvůr Kralove	22.8.71
						Jacksonville	22.6.72
						San Antonio	22.4.78
170	M	DVU 02 Kan	69	8.11.79	wild/wild	Dvůr Kralove	22.8.71
171	M	DVU 03 Murray	69		wild/wild	Dvůr Kralove	22.8.71
						Wroclaw	29.10.74
						Dvůr Kralove	3.10.80
						Zürich	22.4.83
172	M	DVU 04 King	69	22.4.78	wild/wild	Dvůr Kralove	22.8.71
173	F	DVU 05 Zina	69	26.6.78	wild/wild	Dvůr Kralove	22.8.71
174	F	DVU 06 Elsa	69	7.4.78	wild/wild	Dvůr Kralove	22.8.71
175	F	DVU 07 Jimmy	69		wild/wild	Dvůr Kralove	22.8.71
176	F	DVU 08 Lenka	69	17.4.82	wild/wild	Dvůr Kralove	22.8.71
						Jacksonville	22.6.72
						Columbos	14.5.73
177	F	DVU 09 Tuty	69	24.5.78	wild/wild	Dvůr Kralove	22.8.71
178	F	DVU 10 Jarca	69		wild/wild	Dvůr Kralove	22.8.71
216	M	DVU 11 Addo	72	31.1.78	wild/wild	Dvůr Kralove	2.7.74
						Lesna	20.4.76
217	F	DVU 12 Sabi	72		wild/wild	Dvůr Kralove	26.6.74
						Zürich	22.4.83
218	F	DVU 13 Satara	72	24.4.81	wild/wild	Dvůr Kralove	2.7.74
						Lesna	20.4.76
						Dvůr Kralove	13.7.79
244	F	DVU 14 Elvira	2.10.77		170-172/174	Dvůr Kralove	2.10.77
268	M	CVG 09 Iaia	3.11.77		247/180	Cincinnati	3.11.77
						Dvůr Kralove	17.11.78
282	F	DVU 15 Sali	5.7.78		170/217	Dvůr Kralove	5.7.78
283	M	DVU 16 Jima	18.3.79		172/175	Dvůr Kralove	18.3.79
386	M	DVU 17 Eli	15.5.84		268/244	Dvůr Kralove	15.5.84
387	F	DVU 18 Jessi	8.12.84		268/175	Dvůr Kralove	8.12.84
388	M	DVU 19 Sado	26.8.86		268/282	Dvůr Kralove	26.8.86
						Atlanta	15.10.89
391	M	DVU 20 Joe	21.5.89		268/175	Dvůr Kralove	21.5.89
417	F	DVU 21 Sany	1.10.89		268/282	Dvůr Kralove	1.10.89

Table 1: History of animals received to Dvůr Králové Zoo

Date of arrival	Number	Birthplace	Death	Transfer State to 1.1.1990	
22.8.71	4/6	Kenya	2/3	2/1	0/2
26.6.74	0/1	Kenya	-	0/1	-
2.7.74	1/1	Kenya	0/1	1/0	-
17.11.78	1/0	USA	-	-	1/0
Total	6/8		2/4	3/2	1/2

Table 3: Serological results

Animal	1/0 Ken	0/1 Jarca	0/1 Jarca	0/1 Jimmy	0/1 Satara	1/0 Eli	1/0 Sado
Date of blood sampling	8.11.79 death	21.11.79	5.5.89	17.4.81	24.4.81 death	13.1.89	22.9.89
Leptospirosis	L.grippotyph. Z6 1:3200 P125 1:6400	neg	neg	neg	L.grippot. Z6 1:12800 P125 1:12800	neg	neg
Listeriosis			neg	neg	neg	neg	
Salmonellosis			neg	neg	neg	neg	
Brucella							
B. abortus				neg	neg		
B. melitensis				neg	neg		
TBC			neg			neg	
Rhinopneumonitis equorum			1:16			1:16	
Anaemia infectiosa eq.			neg			neg	

vagina to the extent of not more than 20 - 25 cm. Rectal examination was complicated, and we inspected only one ovary and defined the cervix and part of the uterus. We also used ultrasound equipment (f. Apeco), but findings were unreliable. We tried to provoke oestrus in the same female by using the preparations for equine practice. Eight days after i.m. injection of 750 µg of fluprostenolum (Alestrum, Spofa), we applied 2,000 I.U. of gonadotropine (Serovy gonadotropin ad us. vet., Spofa), and eleven days after the first injection the second dose of 750 µg of fluprostenolum was intramusculary injected. The female was in contact with the male through the whole procedure. There was increased contact between female and male four and five days after the last injection, but without other signs of sexual behaviour. Metabolites of gonadal hormones were determined in urine or other excrements, using one of the new methods of functional examination of reproductive organs. RAMSEY et al. (1987) referred to determination of oestrogens and their metabolites and pregnanediol-3-glucuronide in urine of black rhino. He found that these metabolites were not very suitable for determination of oestrus in this species. This non-invasive method proved to be very useful. In collaboration with other institutions, we, therefore, tried to find the best way to determine the reproductive cycle in black rhino.

Immobilization, sedation

At present we have used only an etorphine/acepromazine combination (LA Immobilon, C-Vet) for immobilization of black rhinos in our collection. We have so far immobilized 5 animals in 7 cases (transfer 3x, wound treatment 2x, examination of reproductive organs 1x, retentio secundinae 1x). Complications causing death occurred in two cases. Both animals had been immobilized for transfer. One male died of volvulus of intestines two days after immobilization and translocation. The dose of drugs is not known. One female with chronic symptoms of haemolytic anaemia died due to cardiac arrest 15 min after injection of the drug. The dose was 1.8 ml. According to experience in the other five cases, we use 0.9 - 1.2 - 1.4 ml of LA Immobilon for animals more than four years old, depending on health condition. Those doses correspond to findings by KING (1969), BOEVER (1976), PLATZ et al. (1979), LANG (1982), FOWLER (1986), MARUSKA et al. (1986), GÜLTENBOTH (1986), SVOBODNIK et al. (1988), and BEVERLEY et al. (1988). In our cases, the animals became ataxic for 2 - 6 minutes and laid down or were knocked down, 10 - 19 minutes after the injection. The animals returned to standing position 2 - 4 minutes after i.v. administration of an antidote. Recovery was usually sooner and smoother than in white rhino, and postanaesthetic somnolence was not so obvious. Only in one twenty-year old female with retentio secundinorum was post-anaesthetic somnolence strongly extended, up to the third day after treatment. Anaesthetics were administered by means of an injection gun to the neck muscles (Cap-chur syst.). The respiratory rate dropped to 5/min. This was in agreement with HOFMEYER et al. (1975), but was below findings reported by HAIGH (1977). Pulse was usually regular, 100 - 140/min, this value being higher than data by other authors. During anaesthesia, slight sweating was evident on face and neck, but it was much slighter than in white rhinos.

Drugs for sedation were described by LANG (1982) and SVOBODNÍK et al. (1988). We orally applied 0.1 - 1.0 - 1.5 mg/kg of diazepam (Diazepam susp., Spofa, Diazepam premix, Spofa) for sedation of five animals for transfer. The animals were mildly sedated and were quiet during manipulation.

Haematological and haematochemical values

There is no need to emphasize the importance of laboratory investigation for health control or for diagnosis of disorders. For rhinoceros, as for all long-living mammals, it is very important to know about the haematological and haematochemical profile for the species as a whole and for each individual. With non-sedated rhino, blood can be collected from ear veins. This way we can obtain only small volumes for haematological examination.

If the animal is strongly sedated or even anaesthetized, blood can be taken from large ear veins or veins on median surface of the legs (v. cephalica or v. saphena).

The number of samples was very small. Therefore, only individual values obtained over the last ten years are given in Tables 4 and 5. They were not interpreted. There was only evidence to higher values of red blood cell counts, haemoglobin and haematocrit in immobilized animals, in comparison with non-sedated animals which correlated with our previous findings in perissodactylids (POSPÍŠIL et al., 1986). These values were obtained from clinically healthy animals and corresponded to values given by MARUSKA et al. (1986), KOCK (1987), and BEVERLEY et al. (1988). In comparison with GHEBREMESKEL et al. (1988), the levels of alpha-tocoferol in our three captive animals were at the levels of alpha-tocoverol found by these authors in wild black rhinos.

Clinical problems

Health problems of black rhinos at Dvur Kralove Zoo may be subdivided by three groups:
1. Traumatic diseases;
2. Diseases of skin and mucosa;
3. Haemolytic anaemia.

Traumatic erosions are usually caused by fighting among individuals. Lesions are largely located in head and horn regions. Spray of antiseptic drugs are sufficient for superficial wounds. One female knocked off its horn with consequent bleeding from the wound. The animal recovered without treatment. Incised wounds of lips caused by sharp objects inside boxes occurred in several cases. No treatment was used. Bleeding of nostrils caused by tough fighting in unsuitable housing conditions occurred relatively often. Vitamin K1 (Kanavit, Spofa) was administered in such cases. Traumatization of the tail caused by careless manipulation led to necrosis and demarcation of the injured part of the body. Unexpected contact occurred between Indian and black rhino males during the night. We had to immobilize twice the black rhino male for treatment. The animal was severely wounded on the area of penis, scrotum, and caudal part of the pelvic area between the hind legs and had numerous wounds and traumatic lesions all over the body surface. Treatment included antiseptics and partial wound suturing as well as injections of depot antibiotic (Penicilin depot, Spofa), anti-tetanoid serum (Serum proti tetanu, Bioveta), tocoferolum aceticum (Erevit, Spofa), vitamin K1 (Kanavit, Spofa), and natrium selenosum (Selevit, Spofa). Healing was very good. In such cases of multiple contusions, one should consider possible development of large subcutaneous haematomas, as was suggested by GÜLTENBOTH (1986).

Dermatoses and mucosal diseases of rhinoceros were described by JONES and THOMSETT (1972). In our Zoo superficial fissuring of the epidermis occurred relatively often leading even to foliative dermatitis. Excessive overdrying of the skin, caused by low air humidity inside the pavilion or absence of mud wallow or superficial frostbite by extended exposure to low outdoor temperature were the main causes. Spray of clean water or oil emulsion was sufficient for treatment. Apical parts of the body, especially ears can freeze all over, as happened to our breeding male which had been exposed to very low temperature, more than 10°C below zero. Extensively frostbiten parts of the ears necrotised and fell off. Antiseptics and therapeutic liniments were topically applied. Small papular and pustular alterations occurred to the skin in several cases. Some of them contained pus from which pathogenic organisms were isolated, including staphylococci, streptococci, and yeasts. These findings were in agreement with reports by CLAUSEN and ASHFORD (1980). Having in mind the work by GRUNBERG and BURTSCHER (1986), we also conducted virological examinations, though with negative result. Oil emulsion with antiseptics was locally applied and was supplemented by oral administration of vitamins A and B. Recurrent pustular alterations were recorded from the skin of three animals, with bleeding base. They were located on the neck, back, and flanks of rhinos, similar to findings described by SCHMIDT et al. (1982) in connection with possible toxic liver degeneration. Ulcerative erosions of mucosa of

Table 4: Haematological values of clinically intact black rhinos from Dvur Kralove Zoo (unpublished data)

	Non-sedated animals					Animals sedated by LA Immobilon	
	O/1	O/1	O/1	O/1	O/1	O/1	O/1
Erythrocyte count (10^{12}/l)	4.40	4.76	4.10	4.30	3.64	5.08	5.42
Haematocrit (l/l)	0.42	0.39	0.40	0.35	0.24	0.44	0.55
Haemoglobin content (g/l)	178	154	143	136	120	172	190
Mean corpuscular haemoglobin (pg)	40.4	32.3	34.9	31.6	33.0	33.8	35.0
Mean corpuscular haemoglobin concentration	0.424	0.395	0.357	0.389	0.500	0.391	0.345
Mean corpuscular volume (fl)	95.4	81.9	97.6	81.4	65.9	86.6	101.5
Leucocyte count (10^9/l)	12.5	9.2	6.8	7.8	7.2	10.9	11.2
Neutrophil granulocytes	0.52	0.48	0.59	0.61	0.44	0.69	0.48
Eosinophil granulocytes	0.02	0.01	0.01	0.01	0.05	0.02	0.01
Basophil granulocytes	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Lymphocytes	0.35	0.43	0.33	0.32	0.50	0.29	0.49
Monocytes	0.10	0.07	0.07	0.06	0.01	0.00	0.02

Table 5: Blood biochemistry values of clinically intact black rhinoceroses from Dvur Kralove Zoo (unpublished data)

	Non-sedated animals		Animals sedated by LA Immobilon		
	0/1 S	0/1 P	0/1 S	0/1 S	0/1 S
Total protein, g/l	65		61	97	
Glucose, mmol/l	4.38		7.10	5.49	
Creatinine, µmol/l			128	195	
Urea, mmol/l	3.83		5.20	4.33	
Total lipids, g/l			2.4	1.1	
Triglyceride, mmol/l				0.99	
Cholesterol, µmol/l			2.10	2.53	
Alkaline phosphatase, µkat/l	0.67		1.93	0.98	
AST, µkat/l	0.45		0.58	0.44	
ALT, µkat/l	0.35		0.16	0.18	
GGT, µkat/l			0.9		
CK, µkat/l			8.53		
LDH, µkat/l			5.49		
Magnesium, mmol/l	1.02		0.78	0.74	
Calcium, mmol/l	2.94		2.72	2.88	
Phosphorus, mmol/l	1.45		0.79	1.55	
Chlorides, mmol/l			95	88	
Sodium, mmol/l			133		
Potassium, mmol/l			5.05		
Iron, µmol/l	38.7				
Copper µmol/l			26.0		
Vitamin A, µmol/l			0.9		0.0
Vitamin E, µmol/l		6.3	2.6		2.5
Vitamin C, µmol/l			5.0		10.0

S - serum

P - plasma

oral cavity and nostrils were exhibited by two of these animals, either simultaneously or consecutively. The typical clinical findings of this disease in black rhino were described by OTT et al. (1982) as ulcerative stomatitis and particularly by FOWLER (1986) and HARUSKA et al. (1986). We detected the first signs of this in five animals of our garden since 1975 (1,0 Addo, 1975, 0,1 Zina, 1975 - 1978, 0,1 Tuly, 1976, 0,1 Sabi, 1976 to 1983, 0,1 SALI, 1982 - 1989). The disease was initially characterised by occurrence of granulomatous erosions of the gingiva, different in size, of great raspberry appearance with intermittent localisations on both jaws or mucosa of nostrils in some cases, with prominent bleeding and eshoring of necrotic tissue detritus during healing (Fig. 1). The animal turned apathic and somnolent, with partial anorexia at the beginning, but during healing the behaviour of the animal returned to normal. Lesions usually healed just as well without treatment, within different periods of time, though recovery was sooner with treatment (Fig 2). We have so far recorded 38 cases, with 28 recurrences in one female between 1982 and 1989. Tissue samples were histologically diagnosed as nonspecific granulomas of unknown cause. Virological examinations were negative. Bacteriological culturing revealed mixed, probably secondary infections by staphylococci, streptococci, Corynebacterium, and Escherichia coli. Except for slight neutrophilia, basic haematological findings did not differ significantly from values of healthy animals (Table 6). There are different opinions on the main cause of this disease, both in the literature and personal experience of zoo veterinarians. Vitamin A or C deficiencies, stress, allergy or other still unknown factors are considered to be the cause of this disease. In our female which is now the only individual of our black rhino collection with occurrence of this disease, we use only local antiseptic treatment and oral administration of vitamin K1 (Kanavit, Spofa). This female receives throughout the year 3.0 g of tocoferolum aceticum (Combinal E forte, Spofa), 650,000 I.U. of retinolum propionicum (Combinal A forte, Spofa), and 7.0 g of acidum ascorbicum (Celaskon 25 % pulv., Spofa) as supplement to the daily diet. It is true that signs of this disease were markedly reduced after regular application of these vitamins. We have never completely examined all ill animals. The aetiology of this disease, therefore, is still obscure. In connection with skin problems, we can only presume metabolic disorders. Three of our affected females had normal births, and only one daughter of them (Sali) was affected, too. Sali is now mother of its second young, and we have not recorded any erosion from either young animal. Haemolytic anaemia was very often a limiting factor to breeding of black rhino in captivity. Many authors have studied it (MILLER and BOEVER, 1982; PAGLIA et al., 1986; CHAPLIN et al., 1986; MILLER et al., 1987; JAROFKE and KLÜS, 1988), but the cause has remained obscure. Leptospirosis, blood parasites, enzyme deficiencies, nutritional deficits clostridial infection, toxicity of auto-immune haemolytic anaemia, and drug sensitivity have been discussed as possible causes (MILLER and BOEVER, 1982). Especially MILLER and BOLIN (1988) discussed the question of influence of leptospirosis. BEVERLEY et al. (1988) checked on haemoglobin stability in connection with this disease. At present, lack of vitamin E is considered to be an important factor. DIERENFELD et al. (1988) and GHEBREMESKEL et al. (1988) found significant differences between wild and captive rhinos regarding the level of alpha-tocoferol in plasma or serum. The level of alpha-tocoferol of animals in captivity was found to be practically unmeasurable. GHEBREMESKEL et al. (1988) found at the same time that there were differences in vitamin A levels.

Apathy, anorexia, weakness and haemoglobinuria are typical symptoms of this disease. Many animals have died, soon after outbreak. In chronic courses, health condition gradually improved to nearly normal, but recurrencies were frequent. Such condition can last for years. Physical conditions of animals are worse, and eventual death usually is not avoidable. Death occurred often during anaesthesia or in post-narcotic periods when somebody tried more thorough investigation of the patient. Postmortem findings were characterised by impressive deposits of hemosiderin in internal organs, especially liver, and in the digestive tract (MILLER et al., 1987). Red blood cell counts usually drop under 2 mil, and haematocrit may drop far below 0.36 l/l and sometimes 0.04 l/l. Nuclear forms of red blood cells as a sign of fast haematopoiesis may be recordable from the blood count

Table 6: Haematological values of non-sedated animals with haemolytic anaemia and ulcerative stomatitis

	1/0 Ken Haemolytic anaemia		0/1 Sali Ulcerative stomatitis
	A	B	A
Erythrocyte count, (10^{12}/l)	1.92	5.52	2.07	4.48
Haematocrit, (l/l)	0.04	0.45	0.22	0.32
Haemoglobin content, (g/l)	64	123	68	144
Mean corpuscular haemoglobin, (pg)	33.3	22.3	32.8	32.1
Mean corpuscular haemoglobin concentration	1.600	0.273	0.309	0.450
Mean corpuscular volume, (fl)	20.8	81.5	106.3	71.4
Leucocyte count, (10^{9}/l)	11.3	7.0	6.7	6.6
Neutrophil granulocytes	0.53	0.72	0.52	0.71
Eosinophil granulocytes	0.00	0.00	0.00	0.03
Basophil granulocytes	0.00	0.02	0.00	0.01
Lymphocytes	0.40	0.12	0.44	0.22
Monocytes	0.02	0.00	0.04	0.03
Promyelocytes	0.01	0.00	0.00	
Metamyelocytes	0.03	0.00	0.00	
Lymphoid cells	0.00	0.14	0.00	

A - acute stage

B - interval between two episodes of haemolytic anaemia

MILLER et al., 1987). Antibiotics, short-acting steroids, vitamin E, and selenium drugs are suggested for treatment (MILLER et al., 1987).

On our premises, clinical symptoms of haemolytic anaemia with or without haemoglobinuria grew manifest in four animals, always in chronic form. Apathy, anorexia, somnolence, dark or normal urine, and gradual body wasting were the first observed signs. These symptoms usually faded away for some time after symptomatic treatment, using antibiotics, vitamins B, and K, and changes in diet, but sooner or later the general condition of the animals worsened, and haemoglobinuria was followed by death. Unfortunately, only sporadic investigations were done, with only very few results. Haematological findings from one male during two episodes of haemoglobinuria are shown in Table 6. This male died six months after the last blood analysis. Postmortem findings are briefly described. None of the animals was separately examined for blood parasites. The last case so far of a haemolytic episode occurred in our garden in 1981. Since 1986 - 1987, tocoferolum aceticum (Combinal E forte, Spofa) has been added to the diet of all black rhinos. So, at present, the total amount of tocoferolum aceticum in the diet increased to 950 mg per animal.

Other findings

Retentio secundinarum occurred in one case. A twenty-year old female was immobilized the second day after parturition, and after-births were manually removed. Antibiotic suppositories (Tetramykoin supp., Spofa) were used for treatment. Not other complications occurred.

Pathological findings

Six black rhinos died at Dvur Kralove Zoo, four of them during a very short period of two months in 1978. All animals had originated from Kenya. Unfortunately, we have only two pathological protocols available at our zoo. The summary of pathological findings is, therefore, incomplete. Case histories suggested that animals at least five showed signs of a haemolytic crisis at different stages during their life.

Some individual cases:

0,2 Zina, Elza - apathy, anorexia, haemoglobinuria one day before death; probable cause of death: haemolytic anaemia. 1,0 King - immobilization and translocation two days before death, apathy, increased water intake and vomiting of great amount of fluid, without faecal excretion, colic symptoms; cause of death: volvulus of intestines.
0,1 Tuly - apathy, weakness, lying nearly all time two days before death, the second day somnolent, anorexic, without urination and faecal excretion; cause of death: haemolytic anaemia.
1,0 Ken - severe apathy, anorexia, haemoglobinuria one day before death; postmortem findings included systemic atherosclerosis, myocardial degeneration, chronic interstitial nephritis, systemic haemosiderosis, cachexia; serological examination revealed positive reaction to Leptospira grippotyphosa; cause of death: haemolytic anaemia.
0,1 Satara - death during immobilization; pathological findings included chronic bronchopneumonia, myocardial degeneration, systemic haemosiderosis; serological examination revealed positive reaction to Leptospira grippotyphosa; cause of death: cardiac collapse.

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Summary

Brief Analysis of Veterinary Care of Black Rhinoceros (Diceros bicornis) at Dvur Kralove Zoo

Experience in breeding, housing, nutrition, reproduction, and veterinary care of black rhinos kept at Dvur Kralove Zoo between 1970 and 1989 are briefly described. Ulcerative stomatitis and haemolytic anaemia are considered to be the main factors to influence breeding of black rhinoceros in captivity.

Zusammenfassung

Kurze Analyse der tierärztlichen Betreuung des Spitzmaulnashorne (Diceros bicornis) im Zoologischen Garten Dvur Kralove

Es werden kurz die Erfahrungen mit der Zucht, Fütterung, Reproduktion und tierärztlichen Betreuung bei Spitzmaulnashörnern im Zoologischen Garten Dvur Kralove in den Jahren 1970 - 1989 beschrieben. Unter tierärztlichen Gesichtepunkten sind die ulzerative Stomatitis und die hämolytische Anämie die wichtigsten begrenzenden Faktoren für die Fortpflanzung in Gefangenschaft.

Résumé

Brève analyse des soins vétérinaires au rhinocéros noir (Diceros bicornis) dans le Jardin zoologique de Dvur Králové

Sont présentées très brièvement les expériences du domaine de l'élevage, de l'alimentation, de la reproduction et des soins vétérinaires avec le rhinocéros noir au Jardin zoologique de Dvur Králové au cours des années 1970 - 1989. Du point de vue des vétérinaires, la stomatite ulcérative et l'anémie hémolytique sont les facteurs limitatifs essentiels pour la reproduction de cette espèce en captivité.

Резюме

Краткий анализ ветеринарно - медицинского контроля остроносого носорога (Diceros bicornis) в зоологическом саду Двур Кралове

Дано сообщение о разведении, кормлении, репродукции и ветеринарно - медицинском осмотре остроносого носорога в зоопарке Двур Кралове с 1970 по1989 год. С ветеринарной точки зрения ограничивающем фактором разведения являются ульцеративный стоматит и гемолитическая анемия.

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Fig 1: Initial state of ulcerative stomatitis
(0/1 Sali, 24.2.82)
Foto by Z. Čermák

Fig 2: Ulcerative lesion in regression
(0/1 Sali, 16.3.82)
Foto by Z. Čermák