

3.10 RHINOCEROSSES

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3.10.1 SPECIAL COMMENTS

Rhinoceroses are considered animals with special display value. They can become very tame. They do not regard man as their rival or as a member of their own species. Only few accidents have been reported with human involvement. A keeper at Basle Zoo had his pelvis broken by an Indian rhinoceros bull striking him while running down the aisle.

Today there are four genera with five species of which two are confined to Africa:

1. Black rhinoceros—*Diceros bicornis*
 2. White rhinoceros—*Cerathotherium simum*
- Three are indigenous to Asia:
3. Indian rhinoceros—*Rhinoceros unicornis*
 4. Java rhinoceros—*Rhinoceros sondaicus*
 5. Sumatran rhinoceros—*Dixerorhinus sumatrensis*

They are placed together with the horses and tapirs in the order of the odd-toed mammals (*Perissodactyla*). The zoo veterinarian is required to use the equine approach and not that of ruminants.

All species of rhinoceroses are threatened with extinction and they are therefore especially valued in zoo collections. Survival of the species may depend on these collections. Both African species and the Indian rhinoceros are currently shown in zoological gardens. Breeding in captivity has only recently been achieved in all three species. In the wild some rhinoceroses frequent arid bushveld (African species) with a social mode of life and some degree of adaptability. Others inhabit marshy areas (Indian rhinoceros), and two species live as solitary animals with poor adaptability. This is to be considered in the maintenance of these animals.

The normal body temperature of rhinoceroses is around 37.5°C. The heart beats 25 times per minute, the respiration rate ranges from 13–15/minute.

The gestation period of the Indian rhinoceros averages 480 days based on 9 male calves, compared to 476 days for 10 female calves. The average established from 21 births was 478 days (minimum 462, maximum 489 days). The average based on 11 births was 454 days (minimum 419, maximum 463 days) in the black rhinoceros (846).

Unless the animal is anesthetized, blood can be collected by gentle lancing of an ear vein (dorsal aspect), but only small quantities can thus be obtained.

Injections are best applied by means of the *cap-chur* gun into the cervical

region or into the folds behind the shoulder if the animal has been confined appropriately.

Once adapted, rhinoceroses have a good longevity. Records reported for the Indian rhinoceros (two cases in Antwerp and London) are 40 years, for the black rhinoceros only 30, 27, 25, and 22 years (257). Information concerning the white rhinoceros is still scarce as larger numbers have been kept in zoos only since the 1960's (1283). The first breeding of the black rhinoceros occurred in Brookfield Zoo, Chicago, in 1941. The first captive Indian rhinoceros was born at Basle Zoo in 1956. The animals are kept there in an open enclosure, with access to single stalls. Thirteen animals have been born in this zoo. The size of the enclosure is just big enough to permit sufficient exercise, which seems to be necessary for successful breeding. It has only recently been possible to breed white rhinoceroses in captivity, probably due to the availability of larger runs and the establishment of groups of up to 22 animals (Whipsnade and San Pasqual, San Diego).

3.10.2 CHEMICAL RESTRAINT

Considerable experience in the use of anesthesia in black and white rhinoceroses has been gained by the South African game wardens who have captured and translocated hundreds of animals to other national parks or zoological gardens. For this purpose the animals had to be immobilized by means of *cap-chur* guns or crossbow (75, 184, 185, 282, 606, 611, 613, 614, 670, 794, 808, 809, 1195, 1475, 1683).

Parkesernyl[®] which was initially used in combination with *Themalon*[®] and *Scopolamin*[®] ("cocktail") has now been replaced by *M 99*[®] (*Etorphin*[®]). *M 99*[®] is currently marketed in combination with *acepromazine* designated as *Immobilon*[®]. The advantage is that counteraction can be obtained by injection of an antidote (*Revivon*[®]). Slight sedation can be accomplished with *Combelen*[®] using 10–20 ml per animal (523). Oral application of *Valium*[®] at the rate of 1 mg/kg body weight is suitable for the sedation of Indian rhinoceroses in transit.

3.10.3 PARASITES AND CONTROL MEASURES

With the exception of the tapeworm *Anoplocephala gigantea* (Peters 1856), parasites are of little significance in captive rhinoceroses (1293, 1526).

3.10.3.1 Protozoa

Five types of protozoa have been described in rhinoceros. They appear to be nonpathogenic and to inhabit the posterior parts of the digestive tract as commensals.

Table 15. Currently Recommended Dosage.

Species	<i>Parkesernyl</i> [®]	<i>M-99</i> [®] (<i>Etorphin</i> [®])
White rhinoceros	0.5 mg/kg body wt. Max. dose 250–300 mg	1.5 mg <i>M-99</i> [®] only 120 mg <i>Hyoscine</i> [®] 3.75 mg <i>Acetylpromazine</i> [®] { per 2000 kg body wt.
		1 mg <i>M-99</i> [®] 100 mg <i>Hyoscine</i> [®] { per 1000 lb. body wt. = 453.5 kg
		0.5 mg <i>M-99</i> [®] 1 mg <i>Acetylpromazine</i> (<i>Immobilon</i> [®]) { per 1000 lb. body wt. = 453.5 kg (as tested on over 400 animals)
Black rhinoceros	0.15–0.33 mg/kg or 0.75 mg/kg body wt. Max. dose 200 mg	1.3 mg <i>M-99</i> [®] 55 mg <i>Parkesernyl</i> [®] 85 mg <i>Hyoscine</i> [®] { per 700 kg
		1.5 mg <i>M-99</i> [®] 645 mg <i>Parkesernyl</i> [®] 100 mg <i>Hyoscine</i> [®] { per 900 kg
		1.2 mg <i>M-99</i> [®] 500 mg <i>Parkesernyl</i> [®] 100 mg <i>Hyoscine</i> [®] { per 1000 kg
		1.9 µg/kg <i>M-99</i> [®] 19 µg/kg <i>Acepromazine</i> [®] { 28 animals
		3.3 µg/kg <i>M-99</i> [®] 487–583 grams/kg <i>Azaperone</i> [®] { 3 animals
Indian rhinoceros		1.5 ml <i>Immobilon</i> [®] { per 1600 kg

3.10.3.2 Helminths

Nematodes have repeatedly been reported in African rhinoceroses. Twelve species are known to occur in Kiluluma, and several others in Quilonia (1706, 1707). They belong to the family *Strongylidae*. The hookworm mentioned is

Grammocephalus intermedius, *Oxyuris karamoja* and *Habronema khalili* (*Spiruridae*) have been reported in the black rhinoceros of Uganda. *Parabronema rhinocerotis* (803) has been observed in both African rhinoceroses.

Skin lesions around the ribs behind the elbow often encountered in many black rhinoceroses of East Africa, are believed to be due to infestation with *microfilaria* (43, 1392, 1705). These skin lesions appear to be a great attraction for oxpeckers (*Buphagus erythrorhynchus*). These birds ingest serum, coagulated blood and tissue and thus maintain the lesions. Two black rhinoceroses with skin lesions died during the adaptation period and were subsequently necropsied (1087). *Drascheia megastoma* (*Spiruridae*) were found in the intestinal tract. The skin lesions of one animal yielded *microfilaria*. The adult *filaria* in the other animal were identified as *Stephanofilaria dinniki*. These lesions were manifested by profuse epithelial proliferation with severe *hyper-* and *parakeratosis*.

Anoplocephala gigantea (Peters 1856) is the tapeworm (cestodes) recovered from the Indian rhinoceros bull "Gadadhar" at the Basle Zoo (961). Fecal examination revealed eggs of *Ancylostoma* sp., *Bunostomum* sp. and *Cooperia* sp. as well as a few proglottids of the tapeworm mentioned above. This bull eventually died after an accident and a prolonged illness which necessitated stall confinement on a straw mattress. Approx. 3000 specimens of *anoplocephala* were found in the small intestine at necropsy. This severe infestation had an adverse effect on the animal debilitated by the accident and a protracted *pulmonary fibrosis*. Transmission of *anoplocephala* is believed to occur by *oribatid* mites living in hay or straw. Zumpt (1707) claims a possible host specificity of *anoplocephala* to African, Java, and Indian rhinoceros. Numerous *anoplocephala* were diagnosed in the feces of a black rhinoceros with *enteritis*. That author (819) suspected that "tapeworms may possibly play a role" in this fatal disease.

Brumptia bicanda is the only trematode which was repeatedly found in the intestines of African rhinoceroses. The life cycle of this trematode is unknown. Nematodes are susceptible to modern anthelmintics. Drugs of choice are *Thiabendazole*[®] or *Telmin*[®]. Dosage is according to instructions.

Neguvon[®] was effectively used against *Capillaria* sp. (88 mg/kg body weight) in wild white rhinoceroses (247). *Mansonil*[®] was used by us successfully to eliminate *anoplocephala*. The preparation is added to the water while the animal drinks. Dosage: 160-220 grams per animal at once.

To prevent possible transmission by *oribatid* mites the outside run must be burned from time to time, while the stall requires daily cleaning (no "permanent mattresses").

3.10.3.3 Arthropods

Large fly maggots were found in the stomach of African rhinoceroses as early as 1839 (probably during evisceration of shot animals). These were identified as

Gyrostigma sumatrensis in 1884 after samples from the stomach of a dead Sumatran rhinoceros were examined in Hamburg Zoo (1025). At a later time flies were bred from maggots from an African rhinoceros and two species were discovered. *Gyrostigma pavesii* which infects both species of rhinoceros is widely distributed south of the Sahara. *G. conjungens* is only seen in black rhinoceroses of East Africa. Both are strictly hostspecific. The blood-sucking fly *rhinomusca* is confined in its distribution to white rhinoceroses of Zululand (1160, 1707).

There are records of 26 different species of ticks (*Ixodidae*) in both African rhinoceroses of South Africa. They were found to belong to *Amblyomma* and *Dermacentor* genera. *Amblyomma crenatum* was identified in Asiatic rhinoceros. It is not known if ticks transmit disease in rhinoceros.

3.10.4 INFECTIOUS DISEASES

3.10.4.1 Bacteria

There have been no known recent cases of *tuberculosis* in rhinoceroses, probably due to the decline of this disease. Older reports, however, document a case of *TB* in a black (1025) and one in a Sumatran rhinoceros (43).

3.10.4.2 Viruses

A poxlike disease occurred in a 30-year-old black rhinoceros of Schönbrunn Zoo (Vienna). Clinical evidence included the presence of numerous, rubbery, irregular vesicles and pustules of various size in the flank region, abdomen and inner thigh. Epithelial lesions were noted in the anterior portions of the digestive tract, craterlike ulcers appeared on the esophagus and mucosa of the forestomach. Lymph obtained from these vesicles was inoculated into embryonated chicken eggs. The changes observed were characteristic of *pox*. The agent, however, could not be definitely identified (569).

3.10.5 ORGANIC DISEASES AND TOXICOSES

3.10.5.1 Respiratory System

Severe *pulmonary fibrosis* was found in two Indian rhinoceroses at necropsy in Basle Zoo. The bull "Gadadhar" was sick for more than a year (961). He exhibited intermittent accelerated respiration and gradual weight loss. There was no response to treatment with *Madribon*[®], *Reverin*[®] and *Chloromycetin*[®]. Nevertheless, the bull was able to breed two cows. By October 1964 appetite was

considerably reduced. The respiration rate which had been 60/minute at the beginning of the year dropped to 34–36/minute by the fall of that year. Auscultation could not be carried out because of the thick ribcage and skin. *Libido* also had disappeared by now. The animal died on November 24, 1964. Necropsy findings of this 17-year-old Indian rhinoceros bull revealed severe infestation with *anoplocephala* (approx. 3000 specimens) as mentioned earlier, and “diffuse, reactive, chronic intestinal infiltrates with more or less distinct *pulmonary fibrosis*.” There was also evidence of six broken ribs on the left side and three on the right side as the result of an accident in 1960, when the bull got stuck between two iron posts.

The second incident was a female Indian rhinoceros which was born in Basle Zoo in 1958 and raised here. When the animal was separated from its fifth offspring on September 5, 1972, it suddenly displayed a respiration rate of 56/minute. Slight improvement of the condition was achieved by medication with *Bactrim*[®], later *Predasal*[®] (corticosteroid) was added. The animal did not recover. Initially the appetite was unchanged. Diagnosis could not be established on the basis of blood tests and electrocardiography. Inappetence developed gradually with loss of weight. On January 5, 1973, postmortem examination was performed. The findings were extensive *pulmonary fibrosis* distributed through the entire transverse section of the lung, interlobular and alveolar septums. In addition there was distinct interstitial, panlobular infiltration with round cells.

We believe that this *pulmonary fibrosis* was based on an allergy possibly caused by hay dust or thermophilic spores.

“Arjun,” an imported rhinoceros bull which was owned by Berlin Zoo for the past 7 years replaced the bull “Gadadhar” in order to continue breeding efforts at Basle Zoo. This animal also showed similar symptoms at the beginning of 1973. Respiration rate was slightly accelerated to 28/minute. High doses of *Predasal*[®] and *Bactrim*[®] were immediately applied and this treatment was maintained for 3½ months. Dustfree hay was provided. Respiration normalized slowly and the animal recovered. There was no recurrence of the condition until March 1975.

3.10.5.2 Digestive System

Diseases of the digestive system are seldom observed in rhinoceros. One report describes *volvulus* of the small intestine in a black rhinoceros at Frankfurt Zoo (819). Initial symptoms were reduced appetite, lethargy and reduced defecation. The body temperature was elevated (39°C), respiration rate was normal (9/minute). The animal was tame enough to allow rectal examination. No improvement was noted after treatment with *penicillin* and *sulfonamides*. The respiration rate was accelerated 1 week later (20/minute). The nictitating membrane was evident

and teeth grinding became noticeable. The suspected diagnosis was substantiated by another rectal examination: *Volvulus jejuni*. It was then attempted to enter the abdominal cavity by way of the vagina after application of *chloral hydrate*. This approach failed and the animal soon died. Necropsy revealed extensive fibrinous adhesions between intestines and peritoneum in the region of the left flank. The twisted small intestine was clearly visible due to reddish-black discoloration and considerable amounts of fibrin. A "true anomaly" in the area of the genital organs prevented the entrance into the abdominal cavity from the vagina.

A female black rhinoceros which had been traveling since 1950 with Circus Knie died in 1963 after a few days of inappetence. At necropsy there was acute *enteritis* of the anterior parts of the small and the beginning of the large intestines, severe *nephritis* which was purulent in part, and severe focal, subacute *myocarditis* on the right side with dystrophic calcification. Etiology of this disease was never determined. The animal had virtually no symptoms. In 1947 a 2-month-old white rhinoceros was taken to Karthum to be raised. It appeared healthy during the first 8 days. It drank boiled cow's milk with lactose added. The animal died suddenly on the twelfth day. It was found that the entire intestinal tract was inflamed with hemorrhagic areas in the duodenum. Pure growth of *Pseudomonas pyocyanea* (*P. aeruginosa*) was cultured from the intestinal wall. The capture and shipping of this animal may have contributed to the pathogenicity of this organism and thus the death of the animal (1535).

3.10.5.3 Urogenital System

Severe anemia was observed in a Sumatran rhinoceros imported to Basle on July 2, 1959. It had lived in an enclosure in Sumatra for more than 2 years and apparently nutrition was inadequate. Initially there was improvement after administering bivalent iron (*Ferronicum*[®]). However, the hair began to thin and a considerable amount of scales came off the skin of the back. The animal died in September 1961. Diagnosis at necropsy was *renal fibrosis*. Only strings of connective tissue remained from the two organs. *Chronic nephritis* was present in the traces of renal tissue left. The duration of the disease had led to a uremic condition with subsequent skin lesions and chronic *myocarditis*.

Etiology was never determined in two breeding black rhinoceroses which had several attacks of severe *hemolytic anemia* with blood in the urine. The first acute attacks were effectively treated with cortisone. Finally, however, both animals succumbed to the condition (830).

3.10.5.4 Skin and Horn

Skin diseases are occasionally reported. Two Sumatran rhinoceroses without any opportunity to bathe were kept in Vienna (43). They were soon sick with pustular crusty skin. Treatment was not discussed.

Rome Zoo (835) maintained a black rhinoceros with eczema. The tame animal was treated for weeks and finally recovered as a result of regular washing with soap and water whereby the attendant removed the crusts. The sores were then covered with powder and ointment.

Skin lesions have also been described in wild animals. They can reach the size of 5 × 15 cm and are commonly encountered along the ribcage and the front of the body (1274).

Many pictures showing rhinoceroses in the wild demonstrate the presence of skin lesions behind the shoulders. These lesions which can harbor *microfilaria*, have been discussed in the chapter on "Parasites and Control Measures."

These lesions by *filaria* have only been encountered in freshly imported black rhinoceroses in zoological gardens. They generally heal within less than a year.

Severe *ulcerative dermatitis* was found in two freshly imported white rhinoceroses (755). Both animals recovered after months of treatment with antibiotics, sulfonamides, local application of *Thibenzole*® in conjunction with careful feeding. Although bacteria and fungi were recovered from the ulcers, it was believed that the skin lesions were secondary infections due to the run-down condition. There was no evidence of *microfilaria* in these lesions.

These skin lesions were also observed in black rhinoceroses of South Africa (1681). Healing was readily achieved by a combination of ointments, but recurrences were noticed as well. A black rhinoceros developed boils the size of a fist on both flanks and on the back within a matter of days. They were filled with gelatinous material which could be lifted off easily. Only the top layers of skin were affected. The animal showed no sensitivity when the open lesions were touched or sprayed with *Chloromycetin*®. Appetite was maintained and recovery was uneventful. Since bacteriological and virological examination of the vesicles were negative, it was suggested that the lesions were due to feed allergy (523) (Fig. 57).

Organic diseases can reflect on the skin as demonstrated by the Sumatran rhinoceros "Betina" of Basle Zoo.

The two horns which are characteristic for this group are made up of keratin fibers closely adhered to each other. The horn is a skin structure and not to be confused with the horn in bovines. It is situated on top of a hump of the nasal bone. Unfortunately, few animals in zoological gardens possess intact horns. They are frequently damaged by butting, pounding, scraping, etc. Due to the soft nature of the horn compared to the hard objects struck, the horn tends to become nicked, scraped and worn down to the base, which itself often gets damaged. We believe that the excessive use of the horn is due to boredom or situations with psychic pressure. Basle Zoo's Indian rhinoceros cow "Joymothi" used to scrape off her horn on the walls. From then on the walls were covered with vertical split logs. The rhinoceros now stood in front of the wall and continued with its habit by touching the logs only slightly. When the offspring was born and the mother was busy taking care of it, the horn had a chance to

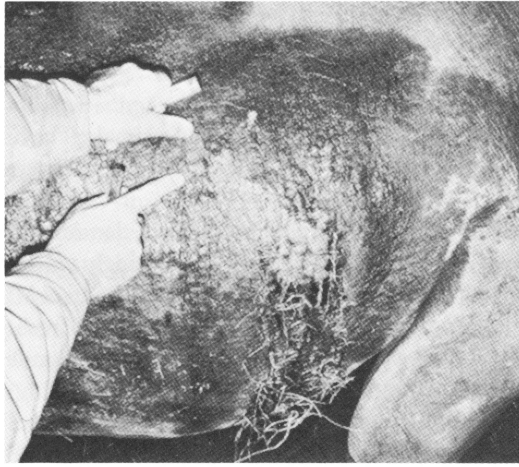


Fig. 57. Black rhinoceros. Extensive dermatitis with vesicles the size of a fist, probably due to an allergy. Healing was uneventful. (Courtesy D. Jarofke)

grow freely. Since she raised eight young, the horn eventually reached a length of 40 cm.

The black rhinoceroses of Zürich Zoo are given the opportunity to work their horns on soft logs of coniferous trees. Their horns are usually long and undamaged.

Wear of the horn can result in damage and infection of underlying structures, namely the arched nasal bone. This has happened in a male Indian rhinoceros of Hamburg Zoo. The animal lived 30 years and always had worn horns which it scraped off on the walls of the stall. The injury finally led to infection which involved the bones of the head. When renal damage was diagnosed as well, the animal was destroyed (136).

A young Indian rhinoceros at Hagenbeck in Stellingen was being treated for injury at the base of the horn, which had become infected and fetid. The injury healed after treatment with 10% salicylic ointment.

The old statement that rhinoceroses shed their horns at regular intervals cannot be confirmed. It may well happen, however, that the odd horn is lost in captivity (1096). Loss of the front horn of a black rhinoceros was reported by Amsterdam Zoo (729). The regrown horn reached the original length within a period of 2 years.

The Indian rhinoceros cow "Joymothi" at Basle lost her long horn on September 21, 1968. It weighed 3.72 kg and was 40 cm long. The animal got stuck in the iron gate while showing enmity toward the bypassing bull. When she pulled back the horn broke off with a clearly audible pop. This created a

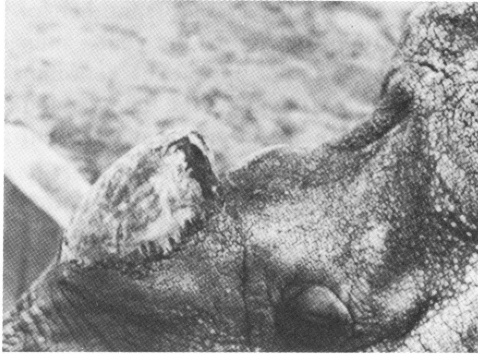


Fig. 58. Indian rhinoceros. Severely worn-down horn with formation of horn crevices. (Courtesy D. Jarofke)

hemorrhagic surface on top of the nose with minor blood loss. The wound was powdered and soon new horn began to grow. The annual growth rate in Indian rhinoceros ranges from 3–5 cm if not worn down (955). Our young female Indian rhinoceros “Moola” lost her horn during anesthesia when she was about 15 years old. She went down slowly but supported herself with the aid of the horn against the wall. When she was down we noticed that the horn had come loose from its base and blood oozed from the detached area. The horn was easily lifted and removed. The wound dried up promptly.

Horn growth after loss of the horn was studied in a white rhinoceros at Berlin Zoo. The new horn grew 9.5 cm within a period of 11 months (833).

Topical treatment of the wound is sufficient in cases of lost horns. It is important to keep the animals occupied to prevent recurrences and habit forming.

3.10.6 HAND-REARING AND DISEASES OF YOUNG

Breeding of rhinoceroses in captivity is a relatively recent achievement and consequently little information is available on hand-rearing (1542, 1599). Some cases are known, however, where young rhinoceroses were caught (41, 239) in the wild and occasionally even reared. It is our opinion that the composition of the milk as we know it from the black and white rhinoceroses may be less critical than hygienic measures during feeding. Soiled milk immediately becomes “bacterial soup” and causes serious digestive problems. A young Indian rhinoceros was raised without any complications on pasteurized, homogenized cow’s milk (3.1% fat, 3.3% protein, 4.7% lactose) as marketed for human consump-

tion. However, it did receive colostrum from its mother for a total of 24 hours (592, 594). The sterilized milk was fed to the young animal directly from the commercial bottle utilizing a sterile nipple. The consumption increased from the daily total of 2-9 liters to 20 liters by the time the young was 1 month old. At 6 weeks the animal began to accept greens and concentrate. Milk was completely eliminated from the diet at 9 months.

Diseases typical for young rhinoceroses are not known provided the diet and management are adequate.

3.10.7 SURGICAL PROCEDURES AND OBSTETRICS

Rectal prolapse was observed in a nearly 5-month-old female black rhinoceros after extensive anal hemorrhage. It was a zoo-born animal still being raised by its mother. The weight was estimated to be 250 kg. It received 200 mg of *promazine hydrochloride* followed by *Halothane*[®] as soon as it had quietened down. Resection was successfully performed and recovery was quick. The animal soon went back to suckle. Etiology of this prolapse was never clarified. Damage of the rectum by the mother's horn was suspected (1163).

The same problem was encountered in a 7-month-old full sister of this animal which also was operated on. The prolapse recurred 5 days later and required another operation. After a second recurrence 20 days later the animal had to be euthanized. It weighed about 500 kg. Anesthesia was produced with 0.25 mg of *M99*[®] (*Etorphin*[®]) plus 3 mg of *acepromazine*. When relaxation was complete it received *Halothane*[®] by intubation to maintain anesthesia.

Two full brothers were successfully raised without any evidence of disease (1161). The relatively few complications associated with parturition are due to the low number of breeding records in captivity. Cessation of labor in a 25-year-old Indian rhinoceros was effectively restored by injecting 10 ml of *oxytocin* via *cap-chur* pistol. Strong contractions set in and a somewhat underdeveloped calf was born within 20 minutes. A calf was manually delivered from a tame black rhinoceros after the fetal fluid was lost 3 hours earlier. The calf was in longitudinal anterior presentation, but rotated 80° to the right which had to be corrected. The mother was quiet and peaceful, but became unexpectedly aggressive the moment the young was to be examined for its sex (830).

Vaginal disinfection by brushing with medicated fluid can be carried out after pregnancy examination or during delivery provided the zoo veterinarian works quietly and carefully. Major operations require sedation with *M 99*[®] (*Etorphin*[®]).

Uterine prolapse occurred in a black rhinoceros 10 days post parturition. This was attributed to a small perforating injury and the animal bled to death (871).