FIELD NOTES

Remote treatment of black rhinos against babesiosis in Ngorongoro Crater, Tanzania

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Abstract

Higher than usual mortality among herbivores in the Ngorongoro Crater was noted beginning in March 2000. In August 2000 a year-old female black rhino (*Diceros bicornis*) was found dead in the crater floor. The carcass was heavily infested with ticks. On 5 and 14 January 2001 two adult resident female rhinos died. The cause of death was suspected to be babesiosis, a tick-borne disease. Microscopic examination of blood smears from the dead rhinos revealed intra-erythrocytic parasites resembling *Babesia* sp. Tissue samples from dead animals analysed using polymerase chain reaction identified *Babesia bicornis*, a previously unknown blood parasite. The life cycle of the parasite is not yet known. The death of the rhinos from tick-borne disease was associated with stress from starvation due to severe drought in the preceding months concurrent with high tick infestation. Two rhinos died from the same disease syndrome. Heavy tick burden at that time was noticeable in both wild animals and Maasai livestock, which are permitted to graze in the crater. Therapeutic treatment of rhinos was undertaken by remote means (darting) using diminazine aceturate (Berenil) to apparent good effect.

Résumé

Au début de mars 2000, on a noté une mortalité plus élevée que d'habitude parmi les herbivores du Cratère du Ngorongoro. En août 2000, on a trouvé le cadavre d'un rhino noir (*Diceros bicornis*) femelle âgé d'un an dans le cratère. La carcasse était très infestée de tiques. Le 5 et le 14 janvier 2001, deux rhinos femelles adultes résidentes sont mortes. On suspecta que la cause de ces décès était la babésiose, une maladie transmise par les tiques. L'examen microscopique de prélèvements sanguins effectués chez les rhinos morts a révélé des parasites des globules rouges ressemblant à *Babesia* sp. L'analyse de tissus des animaux morts par une réaction de polymérisation en chaîne a permis d'identifier *Babesia bicornis*, un parasite du sang inconnu jusqu'alors. Le cycle de reproduction du parasite n'est pas encore connu. La mort des rhinos à cause d'une maladie due aux tiques fut liée au stress de la faim causée par la sécheresse sévère des mois précédents, associée à une forte infestation de tiques. Deux rhinos sont morts de la même maladie. Une forte infestation de tiques était visible à cette époque aussi bien chez les animaux sauvages que chez le bétail des Masai qui peut paître dans le cratère. Le traitement thérapeutique des rhinos entrepris par des moyens utilisés à distance (fléchettes) comprenait du Diminazène (Bérénil) et semble avoir eu un effet bénéfique.

Introduction

Reports of mortality among buffalo and other herbivores in Ngorongoro Crater began in March 2000 (Fyumagwa 2001). The dead animals were heavily infested with ticks but investigators initially suspected rinderpest as the killer due to past experience in the crater. Laboratory analysis performed at the Animal Disease Research Institute (ADRI), Dar es Salaam, Tanzania, and Pirbright, UK, of serum samples collected from 10 immobilized buffalo in the crater ruled out rinderpest (Wiik 2000). Since it is believed that wildlife is fairly resistant to tick-borne diseases (Grootenhuis 2000), ticks were not initially suspected to be a contributing factor in the massive die-off. However, it is known that vector-borne disease epidemics can occur when vector numbers increase due to environmentally favourable conditions or the presence of alternative host species, which amplify vector abundance (Dobson and Hudson 1995).

In 2000 rainfall was below average, resulting in a severe drought in the entire northern zone of Tanzania. Therefore when rinderpest was ruled out, efforts to continue looking for the cause of deaths ceased because it was thought that mortality was a result of starvation. In May 2000 lions took a black rhino calf that was born in the crater floor after her mother (Zakia) failed to protect it. Little attention was paid to the mother's health because the predation was thought to be attributable to the naivety of the mother, who came from Addo Elephant National Park in South Africa where there are no lions.

In early August 2000 a year-old female rhino (Papageno's calf) was found dead with heavy tick infestation. The veterinary staff at Ngorongoro Conservation Area Authority (NCAA) conducted a post-mortem but did not take tissue specimens or blood smears. Meanwhile buffalo and other herbivores continued to die and many carcasses were seen stuck in mud near water sources. This observation led to the suspicion that starvation was the sole cause of the wildlife mortalities. Surprisingly Serengeti National Park, which is adjacent to NCAA, did not record any high mortality among herbivores. In mid-August 2000 an adult female rhino (Zakia, who had just lost her calf) was found dead in the thick bush with her horns intact, thus ruling out poaching as the cause. Unfortunately the carcass was seen when it was at an advanced stage of decomposition and diagnostic samples were not collected.

In early December 2000, two adult resident female rhinos (Fausta and Vicky) exhibited symptoms of red urine and anorexia. In view of the recent rhino mortality over the last few months, NCAA requested a thorough investigation into the condition. Tanzania Wildlife Research Institute (TAWIRI) and NCAA veterinarians went to assess the condition of the two rhinos. This paper discusses the clinical post-mortem examination, results from two animals and treatment that the authorities took to safeguard the remaining small population of rhinos in the crater.

Materials and methods

Clinical examination

The two sick rhinos were seen to be lethargic and anorexic. They passed frothy red urine, and their faeces were unusually dark, almost black. The two affected animals spent an unusual amount of time lying down. After showing these signs for almost two weeks these two rhinos recovered spontaneously. In early January 2001 two adult female rhinos who were original crater residents (Maggie and Bahati) died nine days apart, on 5 and 14 January. Both exhibited similar symptoms of lethargy, anorexia and red urine. These animals both died the same day that the game rangers noticed the symptoms.

Post-mortem examination

The gross pathology in the necropsied rhino carcasses included jaundice in the liver and other visceral organs, frothing in the trachea, bronchi and bronchioles, anaemia, enlarged spleen, haemoglobinuria and dark intestinal contents (melena). Blood smears, brain specimens and lymph node biopsies were collected. Ticks collected from the dead animals were identified as *Amblyomma gemma, A. sparsum, A. tholoni, A. variegatum* and *Rhipicephalus compositus* (Horak 2001; Nijhof et al. 2003). To identify the *Babesia* species involved, blood smears and brain and spleen impression smears were sent to ADRI in Dar es Salaam and duplicates to Utrecht University (Netherlands) for diagnosis using polymerase chain reaction (PCR), a technique that amplifies genetic material enabling identification of the parasites.

Treatment

Following the provisional diagnosis, it was decided in January 2001 to provide therapeutic cover for the re-

maining rhinos in the crater as an immediate temporary solution to the problem. Diminazine aceturate (Berenil® Hoechst) was used to treat the rhinos. Berenil has the advantage of being stable, has a wide safety margin and can be concentrated into a small volume to fit in the 3-ml darts. It has also been administered to black rhino in South Africa without obvious side effects (P. Morkel 2001, pers. obs.). For the injections, 2.36 g Berenil powder was mixed with 1.3 ml sterile water (3 Berenil sachets made up 5 ml of the suspension) and a maximum of 3 ml Berenil suspension was injected per animal. The rhinos received a dose of 2–3 mg kg^{-1} intramuscularly in the neck region. By this time it had started raining and parts of the crater were flooded. Remote injection avoided the stress that might have resulted from immobilizing the rhinos and hand-injecting the drug when they were possibly recovering from drought-related stress.

Results

Diagnosis

The blood smear samples that NCAA veterinary staff submitted to ADRI and those examined on site by NCAA and TAWIRI veterinarians revealed numerous intra-erythrocytic parasites resembling *Babesia* spp. Results confirmed by PCR revealed that the rhinos were infected with a blood parasite, *Babesia bicornis* (Nijhof et al. 2003). The parasite is tick-borne, but the tick species that transmit it are not yet known. Concurrent with the rhino deaths, high tick infestation with a number of different tick species (Fyumagwa and Wiik 2001) was recorded on the crater grassland.

Treated animals

The crater rhinos were treated from 24 to 29 January 2001, with 10 out of 13 animals treated in the operation. Berenil suspension was administered from a distance of approximately 40 to 50 m in nine rhinos; one juvenile rhino was remotely treated at a distance of approximately 15 m while it was moving. The 3-ml darts used had uncollared 40-mm needles as this type of dart falls out easily after its contents are discharged. A Dan-Inject dart gun (JM model) was used; it is quiet and fires relatively light and atraumatic darts.

The post-treatment response was good and no reactions were seen at the injection sites except that one rhino developed an abscess. Fortunately the abscess, in the neck, drained by itself and within two months it was healed.

The three animals that were not treated were orphan calves that were wary and could not be approached, possibly due to the recent loss of their mothers. It was recommended that they be monitored from a distance to see if they formed associations with adults, which would protect them from predators. As their stress levels were probably very high it was also important to monitor their condition in general and watch for clinical symptoms of disease.

Discussion

The disease outbreak among the rhino population in NCA is a newly reported phenomenon. The death of the rhinos was most probably a result of infection with *Babesia bicornis* (Nijhof et al. 2003), which was opportunistic as a result of immunosuppression brought on by stress from severe drought in the preceding months and concurrent with a high level of tick infestation in the crater grassland (Fischer-Tenhagen et al. 2000). Thus the evidence suggests that latent infection with a stress trigger is more likely than sudden exposure to a naïve infection due to poor immune response (Gulland 1995).

It can be argued that conditions of high tick density in the crater and large populations of almost sedentary wild animals in a small area (260 km^2) led to an increase in the prevalence of ticks acting as vectors for blood parasites. Exposure to infection probably increased in rhinos due to sharing the habitat with other wildlife and domestic animals (Fischer-Tenhagen et al. 2000). The total number of rhinos that died from babesiosis is most likely two: the adult cows that died in January 2001. The death of the year-old female calf that died in August 2000 remains unexplained.

A build-up of tick numbers in the crater has been observed since the *El Niño* phenomenon of 1997/ 98 (R.D. Fyumagwa 2001, unpublished data; Cosmas Soombe 2002, pers. comm.). The tick burden was noticeable on animals and in grassland in the crater, where ideal conditions apparently exist for vector-borne diseases (Dobson and Hudson 1995). There was a concurrent increase in tick-borne diseases, especially East Coast fever, anaplasmosis and babesiosis, in cattle that were brought into the crater to water, salt lick and graze (Fyumagwa 2001). The disease called ‘ormilo’ by the

Maasai (cerebral theileriosis) emerged in cattle at the same time that wild herbivores were dying in large numbers (J.O. Mollel 2002, pers. comm.).

Recommendation

As prophylactic veterinary treatment does not allow immunity to develop it is not usually recommended in wildlife. But the course of action decided upon and taken in this case was to counter the disease threat to a small population of endangered and very valuable animals. It is therefore important in future to actively monitor conditions that might predispose to a recurrence of this problem: poor nutrition, induced by drought followed by heavy rains, and the associated high levels of ticks.

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