

Successful snakebite treatment in three juvenile African wild dogs (*Lycaon pictus*) with polyvalent antivenom: A Namibian case report

Authors:

Florian J. Weise¹
Rudie J. van Vuuren¹
Katherine E. Echement¹
Matthew P. Cleverley¹
Marlice van Vuuren¹

Affiliations:

¹N/a'an ku sê Research Programme, Namibia

Correspondence to:

Florian Weise

Email:

florian.weise@gmail.com

Postal address:

PO Box 99292, Windhoek, Namibia

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This article reports the first documented treatment of venomous snakebite with a polyvalent snake antivenom from the South African Institute for Medical Research in endangered African wild dogs (*Lycaon pictus*). Three juvenile male animals (6.5 months of age) showed clinical signs after being bitten by an unidentified venomous snake. The signs included loss of appetite, disorientation, impaired locomotion, excessive facial swelling, profuse salivation, reduced respiratory effort and an apparent depressed mental state. Intravenous treatment with isotonic Ringer lactate solution, hetastarch 6% and dexamethazone, subcutaneous administration of procaine benzylpenicillin and benzathine benzylpenicillin, and ultimately intravenous administration of the polyvalent snake antivenom resulted in the complete recovery of all three wild dogs.

Introduction

The African wild dog (*Lycaon pictus*) is one of the continent's most threatened large predators, with the free-range stock estimated at 6371 individuals in 725 packs (IUCN/SSC 2007). In Namibia, the number of free-ranging wild dogs is highly uncertain but has been proposed to be at a critically low level of between 355 and 601 animals (Hanssen & Stander 2004). With these alarming figures, the importance of captive or semi-captive populations may become paramount as a genetic reservoir for research and to augment re-introductions of the species (McNutt *et al.* 2008; Woodroffe, Ginsberg & Macdonald 1997). In South Africa, for example, determined efforts led to the implementation of a coordinated meta-population management scenario, which encompasses nine governed populations in both state and private reserves.

At least five cases of snakebite (two confirmed and three suspected) have been reported across this meta-population since 2001, four of which ended fatally (H.T. Davies-Mostert [Endangered Wildlife Trust], pers. comm., 2011). To date, there is no documented case of snakebite treatment for African wild dogs. Successful treatment would be beneficial given the potential value of individuals for the conservation of the species. However, publications dealing with the diagnosis and treatment of venomous snakebites in southern Africa are available for humans (Blaylock 2005) and domestic dogs (Leisewitz, Blaylock & Kettner 2004). Possible treatments include monovalent and polyvalent snake antisera. The monovalent type counteracts species-specific snake venoms and is available for the boomslang (*Dispholidus typus*), for example, whereas the polyvalent type contains antibodies that neutralise the effects caused by a wider variety of common snake toxins, including those of some species of adders, cobras and mambas (Leisewitz *et al.* 2004; South African Vaccine Producers 2012).

The main purpose of this case study is to report on the first case of using a polyvalent snake antivenom produced by the South African Institute of Medical Research (SAIMR) to treat venomous snakebite in the endangered African wild dog. Details of the protocol that resulted in a successful treatment are provided. It is important to note that owing to the scarcity of supporting evidence this is not a conclusive study on the effectiveness of such treatment.

Case history

In June 2010, the N/a'an ku sê Wildlife Sanctuary in Namibia assumed custodianship of 14 wild-born African wild dog pups. The group consists of nine female and five male animals from the same litter. The animals are currently managed at the sanctuary, with the prospect of re-introducing them into fenced reserves. As part of this approach, the wild dogs were moved from their rearing pen to a multi-hectare enclosure featuring their natural habitat. In December 2010, after only one week in the new area, three juvenile male animals (6.5 months old) were bitten by a venomous snake in a single incident.

On the day, the animals were found in poor condition during a routine visual assessment in the morning. Clinical signs observed included loss of appetite, disorientation, impaired coordination of the limbs and severe facial swelling, the latter in only two of the affected animals. Facial swelling resulted in profuse salivation and the animals appeared to have difficulty swallowing saliva. No frothing or foaming was observed. Furthermore, the animals appeared to be in a depressed mental state.

The three wild dogs were separated from their litter mates and transported to a veterinarian for emergency treatment. Reduced respiratory effort was noted first in two of the animals during transport to the clinic. The third animal began to show facial swelling approximately 1.5 h after the animals were found. Based on the signs displayed by the wild dogs and her previous experience in treating snakebites in domestic dogs, the attending veterinarian confirmed suspicion of snakebite. Approximately 3 h after the initial clinical signs were seen in the first two animals, the third also exhibited reduced respiratory effort.

The veterinarian induced light anaesthesia in each animal, which weighed between 14 kg and 17 kg at the time, by administering 75 mg tiletamine and zolazepam (Zoletil 100, Virbac) intramuscularly to facilitate the necessary treatments. Although the clinical signs were strongly suggestive of snakebite, it would have been impractical and unsafe to treat the animals without the administration of anaesthesia owing to their aggressiveness. Once immobilised, each of the animals received 1000 mL Ringer's lactate solution (Ringer's Lactate, Sabax) and 20 mL hetastarch 6% (Hetastarch 6%, Sabax) intravenously, 13.2 mg dexamethazone (Colvasone 0.2%, Norbrook) also intravenously, and 300 mg procaine benzylpenicillin and 252 mg benzathine benzylpenicillin (Peni LA, Virbac) subcutaneously. Owing to mild corneal irritation observed, the wild dogs also received chloramphenicol, vitamin A eye ointment (ISEE ointment, Virbac) and ciprofloxacin eye drops (Ciloxan, Alcon) prophylactically, although no signs of chemosis or opacification of the cornea were observed. However, there was a possibility that venom had entered the eyes and severe peri-orbital and facial swelling were seen, which resulted in the exposure and consequent irritation of the nictitating membrane in one of the animals. Bite marks were found on the thorax and left hind foot of two of the animals, respectively. Despite intensive examination, no bite marks were observed on the animals' swollen faces. The distance between the fang marks measured 12 mm and was consistent for all the bite marks, indicating that one snake had inflicted multiple bites. No localised swelling was observed at the bite marks, which were cleaned.

The light anaesthesia persisted throughout the afternoon, during which the animals were kept in a shaded cage and regularly cooled down with water to counter suspected fever. Handling of the animals was minimised during this time. Vital functions such as respiration and heart rate were monitored every 10 min. Additional eye ointment (ISEE

ointment, Virbac) was administered approximately every 30 min to prevent further corneal irritation. Despite continued severe facial swelling in all three wild dogs and continued difficulty in breathing, no obstruction of the airways was observed at any time and the animals appeared stable.

A leading snakebite treatment expert in the country was consulted for immediate advice on a further course of action. During his career, he has dealt with the examination, assessment and treatment of more than 800 snakebites in humans and administered antivenom in more than 250 of these cases. He has also advised and assisted Namibian veterinarians in the treatment of snakebites in horses and domestic dogs (C. Buys, pers. comm., 2010). He arrived approximately 6.5 h after the wild dogs had been found to examine visible bite marks, the animals' condition and clinical signs. The animals' reduced respiratory effort continued, although no signs of swelling in the upper airways could be detected. Instead, the animals displayed reduced chest inflation as well as reduced diaphragmatic movements. Based on the results of the examination, the administration of the SAIMR polyvalent antivenom was advised to further stabilise the animals and counteract the effect of the snake venom. It was suspected that the wild dogs had been bitten by either a juvenile black mamba (*Dendroaspis polylepis*) or a Cape cobra (*Naja nivea*), two of Namibia's most common, aggressive and potentially fatal snakes because of their highly potent neurotoxic venom (Branch 1988; Buys & Buys 1983; Marais 1985, 2004). Although the exact identification of the snake was unknown, the expert considered the venom to be neurotoxic. He further stated that the animals had probably received multiple bites each, and that facial bite marks may have been disguised by excessive swelling.



Source: Florian J. Weise

FIGURE 1: Medical emergency team monitoring antivenom administration in two of the three juvenile male wild dog.

Approximately 7 h after the wild dogs were found, the first animal, which showed the most severe clinical signs, received a 10-mL dose of the SAIMR polyvalent snake antivenom intravenously, together with a second intravenous administration of 1000 mL Ringer's lactate solution (Ringer's lactate, Sabax). The animal's response to the treatment was monitored closely, as an anaphylactic reaction could be a possible side effect.

Prior to this incident there has been no documentation of this type of treatment in wild dogs. A total of 10 mL antivenom was administered per animal, at a rate of 1 mL per minute. As no adverse reactions were observed in the animal treated first, the other two received the same treatment 15 min and 30 min later, respectively. The animals were monitored for another 2 h at the veterinary clinic and signs of improved respiratory function were observed. By late evening, the wild dogs were returned to the sanctuary, where they were monitored for the remainder of the night. The animals were maintained in a single quarantine cage without access to food or water. Apart from signs of exhaustion, the animals' general condition and responses improved, likely aided by their recovery from anaesthesia.

During the next 12 h, the facial swelling decreased significantly in all three animals, whilst respiration was fully restored and the animals were alert and responsive. Locomotion had also improved notably but was still slightly impaired, resulting in occasional stumbling. Each wild dog received an intramuscular injection of 13.2 mg dexamethazone (Colvasone 0.2%, Norbrook) 18 h after the initial treatment. The animals were allowed their first access to water 2 h later, and drank copiously. After another 2 h, each wild dog consumed 500 g red game meat that was offered in small portions. By the afternoon, the animals were observed drinking water regularly and moving normally. It was noted that the animals had become increasingly agile as the day progressed.

The animals were reunited with their litter mates two days after treatment, as the only remaining clinical sign was light facial swelling, which continued to decrease. As a result, the irritation of the nictitating membrane in the affected individual had also improved. The wild dogs regained full movement coordination, were active, alert and responsive and interacted with their litter mates. Within five days of the bites, the facial swelling had disappeared altogether and the animals had recovered completely. No residual effects have been observed in any of the three animals since. Thus, a dose of as little as 10 mL of polyvalent antivenom was successful in treating the effects of venomous snakebite in these wild dogs despite it being administered only late during the course of intoxication. In a different case, however, a male wild dog thought to have been bitten by a venomous snake in South Africa lived another five years without having received any treatment (H.T. Davies-Mostert [Endangered Wildlife Trust], pers. comm., 2011).

It is noteworthy that only male animals were bitten during this incident, although the majority of the individuals in the group were female; more interestingly, the affected animals were the three highest-ranking males of the group.

In addition, the same males, together with two high-ranking females, were most inquisitive during a 45-minute encounter with a puff adder (*Bitis arietans*) only nine months later. No individuals were bitten during this encounter. The animals repeatedly circled and approached the snake to within half a metre, whilst the lower-ranking members of the group kept a distance of several metres from the snake at all times. Similar rank-related observations were also made in two of the five recorded snakebite cases from South Africa, in which one alpha female and one alpha male were bitten (H.T. Davies-Mostert [Endangered Wildlife Trust], pers. comm., 2011; K. Potgieter [Endangered Wildlife Trust], pers. comm., 2011). High-ranking group members, especially alpha-rank wild dogs, appear to act more frequently in response to threats against the group than do lower-ranking individuals, as has also been documented during encounters with spotted hyenas (Malcolm & Marten 1982), and therefore appear to be more susceptible to snakebites.

Another peculiarity of our case is that (rapid) swelling was observed only on the animals' heads, whereas no swelling occurred at the visible bite marks. In addition, it is speculated that the animals were found very shortly after the bites had occurred, which likely contributed to the success of the reported emergency treatment. This was supported by the observation that the third animal developed facial swelling only during transport.

Since both monovalent and polyvalent snake antivenoms are classed as registered, scheduled drugs in Namibia, their application and the consequent treatment of affected animals may be undertaken only by registered professionals. Therefore, we suggest that facilities keeping wild dogs under intensive management conditions need to have a snakebite emergency protocol in place that can be based on the experience described here. Such a protocol should enable the fastest possible treatment, starting with separating affected individuals from their group and be followed by their immediate transport and access to an experienced veterinarian who keeps polyvalent antivenom in stock.

Conclusion

This article provided detail of the first successful treatment of venomous snakebite in endangered African wild dogs. A dose of 10 mL polyvalent snake antivenom per animal, together with supportive treatment, was effective in reversing severe envenomation from an unidentified snake in three juvenile animals. The provided protocol should be used as a baseline reference for venomous snakebite treatment in the species, especially in scenarios where individual animals are of significant value to conservation efforts.

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

F.J.W. (N/a'an ku sê Research Programme), R.J.v.V. (N/a'an ku sê Research Programme) and M.v.V. (N/a'an ku sê Research Programme) collected data. F.J.W., R.J.v.V., K.E.E. (N/a'an ku sê Research Programme) and M.P.C. (N/a'an ku sê Research Programme) wrote the manuscript. F.J.W. provided supporting material (Figure 1).

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