

VENOMOUS SNAKES SOUTH OF THE SAHARA, PART 1.

*Lieutenant-Colonel
M.D. Dr. Jack A. van den Engh,
Sassenholz, Germany.*

INTRODUCTION

The following article deals with venomous snakes. What snakes commonly occur South of the Sahara? What measures can be taken after a bite? When is it advisable to consult a doctor? The author is an amateur herpetologist. In his room at the military medical centre, in the army camp Seedorf (Germany), his patients could admire his collection of venomous and non-venomous snakes. Currently he is associated with the 'Hope' foundation and the 'Dutch Hope International' foundation (of which he is the founder) that administers a children's village in Kumi, Uganda.

DISPATCHING

Given the number of current conflicts in Africa, more and more UN military are dispatched to tropical regions. During these missions they often spend periods in the terrain, which may be of short or long duration. The geographical location and the nature of the terrain (savannah, forest, shrub), presence of water (swamp), the climate and the extent of the ecological changes caused by human habitation, determine the habitats of flora and fauna. One can encounter all kinds of unknown and possibly dangerous insects and other animals, among them different species of snakes.

In this article I will mainly deal with the snakes that

occur south of the Sahara desert, of which the bite, if untreated, can have fatal consequences.

First of all however two remarks. There are over 2600 species of snakes which one can possibly encounter in this world, the bite of less than 10% of them is considered potentially fatal for humans. Secondly, fortunately it is a fact that, if worn correctly, military clothing offers a high degree of protection against snake bites.

SOME CHARACTERISTICS

A common belief, is that venomous snakes have, a more or less, pronounced triangular shaped head. However, with most of these reptiles, this is not the case. Therefore this characteristic is not reliable to determine if one is dealing with a venomous snake. One characteristic all venomous snakes share is that during a bite the venom, which is stored in two glands located behind the eyes and above the base of the skull, is carried through hollow or grooved fangs to the bite wound. Venom glands can be regarded as mutated salivary glands. During the bite a number of muscles make sure that these glands are emptied.

The venom fangs are always longer or thicker than the other teeth but can differ considerably in length between species: from only a few millimetres in cobra's (*Naja* spp.) to as much as 3 to 4 cm in the Gaboon viper (*Bitis gabonica*). The difference in diameter offers the possibility, through inspection of the wound, to determine if the bite was caused by a venomous snake.





CLASSIFICATION OF SNAKES

Venomous snakes can be classified in three main groups:

Colubridae.

Most members of this family are not dangerous. Venomous species have grooved, relatively long fangs positioned in the back of the upper jaw. This anatomical fact means that, in the case of a bite, the fangs usually don't even reach the skin. Toxic effects often don't occur. One example is *Dyspholidus typus*, the Boomslang. This name was first given to this reptile in South-Africa. The venom is mostly neurotoxic and can be fatal, by paralysing the respiratory muscles. Death by suffocation.

Elapidae

This family has small, 1 to 2 mm long, solid teeth located in the front of the upper jaw. Through a small channel in these teeth the venom is carried into the wound. Examples are cobra's (*Naja* spp.), mamba's (*Dendroaspis* spp.), coral snakes (*Micrurus* spp.) but also sea snakes (*Hydrophidae* spp.). With most members of this family the venom is neurotoxic. Clinical symptoms after a bite include sweating, drowsiness, heavy eyelids, insensitive lips, sickness and finally difficulties in breathing, that can be fatal.

Viperidae

The viper family. These snakes possess impressive, long fangs positioned on the front of the upper jaw. In rest these fangs are folded backwards towards the palate but they can hinge forward. These fangs also have a channel through which the venom is injected. In the

West African Gaboon viper (*Bitis gabonica*) and the normal puff adder (*Bitis arietans*) these fangs can have a length of 1.5 to 3 cms.

Rattlesnakes (*Crotalinae*) form a subfamily of the *Viperidae*. They do not occur in Africa. The venom of *Viperidae* damages tissue and blood cells (proteolytic and haemotoxic). Soon after the bite it causes mainly local symptoms like huge swellings, discoloration of the skin and pain.

FANGS AND VENOM

Position of fangs in venomous snakes (according to Bolanos)

- Non-venomous snakes: all teeth approximately of equal length
- Colubrids like the Boomslang (*Dyspholidus typus*): two fangs (sometimes more reserve fangs), fixed in the back of the jaw, that are longer than the other tooth elements.
- Vipers like the puff adder (*Bitis arietans*): two hinged fangs, positioned in the front of the jaw with a considerably longer length and diameter than the other tooth elements.
- Elapids like cobra's (*Naja* spp.) and mamba's (*Dendroaspis* spp.): two solid teeth fixed in the front of the upper jaw with a greater length and diameter than the other tooth elements.

Tooth marks in snake bite

- Non venomous: all tooth marks basically the same diameter.
- Venomous: one or two pairs of larger tooth marks visible.

COMPOSITION OF THE VENOM

Snake venom is composed of hundreds to thousands of proteins. It is a mixture of several toxins, enzymes and other proteins. In a number of venomous snakes the neurotoxins prevail. These toxins block the secretion of acetylcholine from the nerve ends, as well as its binding to the receptors in the muscles. It acts like some sort of curare. The venom of other snakes works mostly proteolytic and haemolytic whereby mostly tissue, erythrocytes and the blood clot mechanism is affected. Mixtures of both neurotoxins and proteolytic enzymes are responsible for the diversity of clinical symptoms that can occur after a snake bite.

POSSIBLE SYMPTOMS AFTER A SNAKE BITE

In general the possible action of snake venom can be summarised as follows:

Locally:

- Soon after the bite: inflammation symptoms of the directly affected area (the area is red, warm, painful and swollen).

General:

- often only after a couple of hours: paralysis, bleeding and failure of organs;
- damaging effect on cells and tissues;
- damage to skin and connective and muscular tissue;
- damage to the heart muscle cells;
- damage to the red blood cells and blood vessels;
- prevention of nerve impulses to muscles (pre- and

postsynaptic);

- excitation of the nerve system;
- damage to the blood clot mechanism.

Other factors in a venomous snake bite.

Which symptoms and how soon and serious they manifest themselves after the bite, depends, besides the fact whether the venom is mainly neurotoxic or proteolytic, on the following factors:

- the age and physical condition of the victim;
- the nature of the bite (deep or superficial);
- the place of the bite (the closer to the heart the more dangerous);
- the number of bites;
- the duration of the bite and the amount of venom that was injected;
- the condition of the fangs and the venom glands (damaged fangs, capacity of the glands);
- the sensitivity of the victim to the venom;
- the species and size of the snake;
- the pathogens that occur in the mouth of the snake (secondary infections);
- the nature of the first aid and the subsequent medical attention.

For all these reasons the consequences of snake bites can vary from insignificant to fatal.

GENERAL INFORMATION

Information of species and habitat

It is important to obtain information on which species of venomous snakes and what types of terrain one can encounter in the dispatch region. In general this is not difficult because it usually concerns only a limited number of species. There are many books available





and the book 'Poisonous snakes of the world' contains a detailed list of all the snakes that occur in every country of, among other things, the African continent.

Prevention of snake bites

In case of movement by foot use the passable paths as much as possible. When moving after sunset always wear high boots and long trousers and carry a stick and a torch. Never touch a snake, also not a recently 'killed' one. In difficult terrain use the stick to clear the path. Upon encountering a snake do not disturb or chase the reptile. Stand still, the snake will disappear by itself. African venomous snakes will never spontaneously attack a human who accidentally crossed their path.

Statistically most frequent bite spots

In native people in tropical regions 67% of all snake bites concern the lower extremities. In 50.3% the foot or the area around the ankle is involved, in 15.8% the area between the ankle and the knee and in 1.6% the upper leg. For bites in the hands this is 27%.

The high percentage in which feet are hit can be explained by the fact that many native tropical people go barefoot. The high percentage of hands that are hit is mainly due to tea pickers. Given the protective clothing of military it can be expected that for this group the hands, the forearms and the face will be the most likely places where bites can occur.

Recognition of the bite

A not always accurate, but nevertheless sensible, method to determine if one is dealing with a bite of a venomous snake, is inspection of the wound. In case

two or more (reserve fangs!) bite marks are visible, larger in diameter than the rest, a venomous snake is involved. From the position of the fang marks it can also be deduced if one is dealing with a colubrid (neurotoxic), viper (proteolytic/haemotoxic) or an elaphid (neurotoxic) snake. This will allow a more prompt recognition of the symptoms, which can be helpful for further treatment. Remember that in pigmented skin the aforementioned skin marks can be more difficult to assess.

FIRST AID IN SNAKE BITE

Old-fashioned ideas

The beliefs that after a snake bite first aid should consist of application of a tourniquet as soon as possible and the quick and preferably as complete as possible removal of the venom, are now considered old-fashioned.

Outdated first aid:

- Application of a tourniquet, cuts and suction of the wound.
- Use of a commercial 'snakebite kit'

On the principles of adequate first aid after a snakebite, many, often contradictory views, have been published. These include application of a tourniquet or not, cutting of the wound or the use of a snakebite kit. The confusion was possibly created because only sporadically experts are confronted with real bites. For this reason, a number of theoretical models were devised or tried in the laboratory, after which old insights were replaced by new ones. These include methods that are aimed at slowing down the dispersal of the venom and minimising the damage to the body part or tissue afflicted (Van Kampen, 2001).

Generally the most recent ideas on how to administer first aid after a snakebite can be summarised as follows:

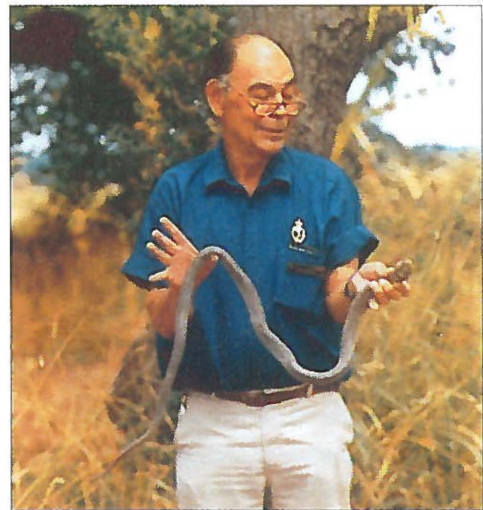
- Let the patient lie down and reassure him. The victim is often in panic. The more quiet and the slower the movements the slower the venom will spread. In case of fainting let the patient sniff some ammonia.
- Inspect the wound for possible fang marks and their position. This can give some clue on whether the bite was from a colubrid, elaphid or viperid snake, enabling an estimate of the symptoms to be expected, or from a non-venomous snake.
- Remove any dirt and venom on the skin by washing with clean water.
- Disinfect the bite area with iodine (Betadine) or alcohol.
- Cover the wound with a sterile bandage and apply an elastic bandage over a wide area between the wound and the heart. This can slow down the spread of neurotoxic venom through lymph nodes and superficial veins.
- Slow down further spread of the venom by immobilising the hit body part, for instance by splinting.
- Move to the nearest hospital as quickly as possible.
- In very remote areas, where it is likely that it will take a long time before a hospital can be reached, it is advisable that a high pressure bandage is applied by using a triangularly folded sling.
- Make notes of the following:
 - type of terrain (savannah, bush, lake side etc.)
 - time of day (diurnal or nocturnal snake?). This data can give information on the identity of the snake involved.
 - When do typical symptoms occur like excessive sweating, swellings, increased frequency of pulse.

Remark: transportation to a hospital in a primitive and remote tropical setting can take some real effort, means and above all, time. The hospital in question also needs to stock the necessary antiserum and have a medical staff who is experienced in these types of treatments.

In Nicaragua, in 1993, I was confronted with the following situation: in a remote area an employee of an aid organisation was bitten, through negligence, by a coral snake (*Micrurus* spp.). It took several hours for the alarm call to reach us. Only because a helicopter of a large aid organisation could be arranged and a hospital in the capital Managua was prepared for this type of emergencies, the patient could be saved. Just in time, because paralysis of the eye muscles was already setting in.

FURTHER REMARKS

Usually it is not possible to catch the snake that caused the bite (in fact it is strongly advised against) or to kill



The author, handling a specimen of Naja nigricollis, Uganda, 2000





it for proper identification. To be absolutely safe it is advisable, when in doubt, to treat every snake bite as a venomous snake bite.

When a bite does occur avoid the consumption of alcohol. It stimulates the blood circulation and therefore the spread of the venom through the body. In case of a bite by a venomous snake always seek medical advice. It is important that the condition of the patient is monitored and stabilised if necessary. Transportation should cost a minimum of physical effort on behalf of the patient, again to keep the circulation as low as possible thus minimising further spread of the venom. Ideally the patient should be moved lying on a stretcher but in practice this can be impossible. Whatever, creativity is essential, using all means that are available.

TREATMENT AT THE MEDICAL STATION

Further treatment at the medical station consists of the following:

- preventing secondary infection by administering broad-spectrum antibiotics. Anti-tetanus treatment is usually not necessary for UN-military because they have been vaccinated. However, from the medical records it should be verified if this vaccination is not overdue. The state and date of vaccination for military from other countries can be quite different.
- Applying an intravenous drip with a physiological saline solution can be useful for any further necessary treatment with antiserum or other medication.
- The patient is then kept under observation until the first clinical signs of the venom become apparent. This wait is important because administering an an-



*The author, with a African rockpython (python sebae).
Uganda, 2000*

tiserum can also bring on complications like anaphylactic shock. Antiserum does contain foreign proteins from the horse that is used to produce the anti-venom.

- Only after intoxication becomes evident a, usually polyvalent, antiserum is given. Either by the drip applied earlier or subcutaneous injection in the area of the wound, depending on the clinical signs. The treatment can be stopped if after 24 to 48 hours no further signs of poisoning have developed.

Antisera to neutralise snake venom is, because of its limited storage life, often only available as a kind of

dry powder. Before use the powder is first dissolved in the fluid supplied with the powder.

Antisera produced in Johannesburg, South Africa, are supplied in a concentrated liquid form that, if stored at a temperature of 2 to 5 degrees centigrade (refrigerator!), can be kept for ca. three years. The antivenom contains antibodies against several venomous snakes that occur in that region (polyvalent serum) and it neutralises neurotoxic as well as haemotoxic toxins. Both dosage and instruction for use are included.

ADDRESSES

Addresses where antisera and further information regarding venomous snakes that occur south of the Sahara can be obtained:

- In South Africa: South African Institute for Medical Research, Hospital Hill, P.O. Box 1038 Johannesburg. Products: Polyvalent antivenin (*Bitis*, *Naja*, *Hemachatus*). Specific antiserum against *Bitis arietans* (common puff adder), *Bitis gabonica* (West African Gaboon viper) and *Naja* species (Cobra's). Polyvalent serum against *Dendroaspis* spp.: *Dendroaspis polylepis* (black mamba) and *Dendroaspis angusticeps* (green mamba), Boomslang antivenin: *Dispholidus typus*.
- In Europe the following institutes supply a extensive range of antisera against venomous snakes, including the most common ones that occur south of the Sahara.
 - France: Institute Pasteur, 36 Rue du Docteur,

Roux, Paris 15

- Germany: Behringwerke AG, Postschliesfach 167, 35037 Marburg. Phone: +49-6421-39-0

IDENTIFICATION OF VENOMOUS SNAKES

For a detailed determination of snakes an extensive system of characteristics can be found in the literature. It mainly involves the number, shape, characteristic of the surface (smooth or keeled) and position of the scales on the head. Those in the middle of the head (frontal), just behind the middle (parietal), under the eyes (labial), above the eyes (supralabial), behind the eyes (post-ocular), between the nostrils (internasal), on the front of the snout (rostral) or above the eyes (temporal). However a more detailed description is beyond the scope of this article.

REFERENCES

Bolanos R.: Serpientes venenos y ofidismo en Centroamerica. Editorial Universidad de Costa Rica. 1984 ISBN 9977-004-8.

US Department of the Navy: Poisonous snakes of the world. Bureau of Medicine and Surgery USN. Dover Publications INC, New York 1991. ISBN 0-486-26629-X

Translation: René van der Vlugt

Corrections: Mark Wootten

