cases. It also seems unlikely that the development of MH could be related to any of the drugs used in treating the leukaemia because of the short time between therapy of the leukaemia and the development of MH, and because of the fact that none of the agents listed was used consistently in every case. It is possible that the development of MH following monocytic leukaemia as occurred in 2 cases may represent a change from a leukaemic to a tissue phase of the same basic process. Castoldi et al. demonstrated that the blasts in the bone marrow of a patient with myelomonocytic leukaemia acquired progressively more anaplastic histiomyocytic features in the terminal stage. As mentioned previously, the cytological features of the histiocytic infiltrate render it extremely unlikely that this results from a tissue reaction to the leukaemic process.

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**References**


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**Boomslang (Dispholidus typus) Bite**

**A Case Report and a Review of Diagnosis and Management**

**D. M. DU TOIT**

**Summary**

Very few cases of boomslang (Dispholidus typus) envenomation have been described. A case report is presented, illustrating many pitfalls in diagnosis and treatment. Despite a fully established clinical picture of diffuse intravascular clotting (DIC), response to specific boomslang antivenom was immediate, even as late as 86 hours after the bite. Some of the literature regarding the snake, the clinico-pathological effects of the venom, and treatment is reviewed and discussed.

Administration of specific antivenom is the only curative measure, while administration of fresh blood and plasma appears to be the most useful supportive measure. Other measures, including the controversial use of heparin and corticosteroids, are discussed.

Reactions to the antivenom, both early and late, are discussed, and methods of prevention and control of reactions are suggested.


**The Snake**

*Dispholidus typus* (known in South Africa as the boomslang or tree snake) is well described by Visser and Chapman in their excellent book.1 It is a large, back-fanged arboreal colubrid, plentiful in tropical and subtropical Africa, and in South Africa in all but the treeless interior. Even there it may occur in lush riverine vegetation. It feeds on small reptiles, particularly chameleons and lizards, as also on birds, their eggs and young. It averages 120 - 155 cm in length and may attain 185 cm.

The commonest colour phases are green (usually males) and brown to black (usually females), causing it most frequently to be confused with the green or black mamba. The green mamba (*Dendroaspis augusticeps*) is strictly arboreal and of limited distribution in south-eastern Africa. The black mamba (*Dendroaspis polylepis*), which is chiefly terrestrial, shares most of the boomslang’s distribution as far as the Transkei.

The harmless spotted bush snake (*Philothamnus semi-variegatus*), which is also green, chiefly arboreal and large-eyed, may be distinguished by the scattered dark spots over the anterior half of the body, and its long and exceptionally slender body and tail.

It has a similar distribution to *D. typus*, from the Eastern Province northwards.2

The boomslang shows remarkable colour variations with sex, age and locality. Green varieties may have black scale-margins, giving it a barred or checkered appearance. In the southern and south-western Cape, it may be black with a yellow belly, or occasionally brick-red near Port Elizabeth. The very young may be grey with yellow throats and black flecks.

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**References**

The major distinguishing feature is the relatively small head, with very large eyes. The body scales, on close inspection, are keeled.

The boomslang is retiring and non-aggressive. If it is cornered, the throat and even the anterior two-thirds of the body can be inflated cylindrically. Strikes are usually defensive under extreme provocation or handling, always on small parts (usually the hand), where the back fangs can penetrate. The snake appears to 'chew' the bitten part, and it may be difficult to disengage the fangs.

In all available reports, envenomation occurred during handling of snakes by herpetologists, collectors and pet keepers — 'illegitimate bites', as Visser calls them. A death has been reported from North America, and a case of a bite in Britain.4,5

The effects of the bite rapidly distinguish a mamba from a boomslang. A mamba's venom acts with extreme rapidity in a curare-like manner, while the boomslang's bite seldom causes immediate serious effects.

THE VENOM

Pathological Effects

In common with the venoms of *Echis carinatus* (African carpet viper) *Agkistrodon rhodostoma* (Malayan pit viper) and the local bird or vine snake (*Theolotornis kirtlandii capensis*), the venom of the boomslang is an extremely potent blood coagulant. With *Echis carinatus* venom, it is the only known substance able to activate plasma prothrombin in the presence of excess citrate (no calcium added).

Mackay et al.6 showed that in vitro a ground parotid extract causes clotting in a dilution of 1/65 000 and also displays mild proteolytic activity (caseinolysis at 1/50), but negligible fibrinolytic activity.

In vivo the most minute amount of venom may cause progressive disseminated intravascular coagulation (DIC) with hypofibrinogenaemia and haemmorrhage, sometimes evident as early as 1 hour after envenomation,6 but more usually between 6 and 24 hours and sometimes even later. The blood is frequently found to be incoagulable. Mackay et al.6 believe that in vivo fibrinolysis may be markedly stimulated, as is also seen in other instances of DIC.

Lakier and Fritz7 point out that while no haemolysis occurs in vitro, it is a marked feature in vivo, possibly due to damage to erythrocytes in contact with fibrin strands within capillaries. Haemoglobinuria and severe anaemia ensue. Thrombocytopenia is frequently but not uniformly reported, and may be severe. Describing the necropsy findings in a fatal case, Spies et al.8 summarize as follows:

'At postmortem examination evidence of haemorrhages could be found in practically every organ, including muscles and brain. Apart from this, the most interesting finding was the presence of fibrin thrombi in capillaries and larger vessels of several organs, resembling the microscopic appearance of thrombocytopenic purpura. Other abnormal findings were an acute tubular necrosis of both kidneys and marked hepatic necrosis of the centrilobular type.' The latter finding was associated with thrombi in the central veins of nearly all the hepatic lobules.

Clinical Effects

Patients often present very late,4,9 only when haemorrhagic symptoms occur, probably being misled by the apparent triviality of the bite, with little local pain or reaction and the relative mildness of the initial symptoms as compared with those caused by front-fanged elapid or viperine bites.

Nausea, vomiting, malaise and severe occipital headache often occur after 1 hour, with occasional drowsiness and confusion. Haemorrhagic signs due to DIC may be seen occasionally within 1 hour of envenomation, but usually much later. Bruising is often widespread, sometimes with bulla or haematoma formation. Gastro-intestinal bleeding with blood in vomitus and stools or bleeding from the mouth, nose and even conjunctivae occurs. Haematuria and haemoglobinuria may be gross while a haemolytic-uraemic syndrome, due to renal tubular necrosis with oliguria, uraemia, and deepening coma, may ensue. This syndrome occurs in most recorded cases to a greater or lesser degree.

THE ANTIVENOM

Specific boomslang antivenom is the only specific treatment. It is strikingly and rapidly effective, even when administered late, and is produced as a freeze-dried equine globulin antivenom, supplied only by the South African Institute of Medical Research (PO Box 1038, Johannesburg, 2000, Tel. 011-45-2294). It is available on well-motivated request (usually in consultation with Dr P. A. Christensen or Dr P. Price) and is not available commercially. The SAIMR spares no trouble or expense in delivering the antivenom to legitimate cases and deserves high praise.

In bites due to the Malayan pit viper, a crotalid in the Far East which causes a similar syndrome, a specific antivenom was shown to be effective. The SAIMR followed with specific *E. carinatus* antivenom, which was used successfully for West African carpet viper bite. Visser and Chapman9 report apparently successful treatment of boomslang bite with *E. carinatus* antivenom even before Grasset produced the first boomslang antivenom from rabbits.

Lakier and Fritz reported 5 deaths in 17 cases prior to 1964, before the antivenom was available,9 and a victim died in North America.9 In the next 5 years, 6 patients received antivenom and all survived. Since then at least 4 more cases have been reported (including this case) and all have survived.4,5,9

Reactions to the antivenom are frequent.9 In 5 cases reviewed (including this one),5,9,9 2 patients had no reaction and 3 had immediate reactions in the form of rigo, fever, dyspnoea (bronchospasm) and hypotension, in that order of frequency. One of these patients also had serum sickness a week later. Two of those who reacted had no warning symptoms after subcutaneous test doses. Response to antihistaminics, adrenaline, and hydrocortisone (and β-stimulators for bronchospasm) was prompt.
Brossy suggests that the high incidence of hypersensitivity to this antivenom is related to the fact that victims are usually herpetologists or handlers who have often been bitten and treated previously, as in this case. It should be noted that the antivenom is useless for treating bites by Thelotornis (bird or vine snake) which causes the same clinical picture.

CASE REPORT

A Black man, aged 25 years, arrived at Pietersburg Hospital on 24 October 1978 with a letter stating he had been bitten by a snake (suspected cobra) 60 hours previously. The patient was semicomatose and restless and the history could only be pieced together after the patient had recovered and from his reference letter.

He calls himself 'The Snake Charmer of Krugersdorp', boasting that he has survived 15 snakebites. He swallows snakes alive for R15. While in Tzaneen, he captured an arboreal snake ('green like a tree') which he thought was a green mamba, which bit him on the web of the right thumb. Nothing immediate happened and he did not seek treatment. He is a known epileptic, taking phenobarbitone and phenytoin and relatives said he had had an attack that day.

About 48 hours after envenomation he was taken to a nearby hospital, already semicomatose, restless and bleeding from the mouth and fang wounds.

Sixty hours after the patient had been bitten, on his arrival at Pietersburg Hospital, the casualty officer noted gross swelling and bruising of the eyelids with bleeding from both eyes, from the mouth and the fang-marks. The patient was semicomatose and restless. The blood pressure was 110/70 mmHg, pulse 104/min, temperature 37.7°C and anaemia was noted. A diagnosis of birdsnake or boomslang envenomation was suggested. Two units of fresh blood were ordered and 60 ml of polyvalent antivenom (SAIMR) were given intravenously with hydrocortisone 100 mg intravenously and adrenaline 1,0 ml subcutaneously at this time.

At 70 hours the patient's condition was worse. In addition to increased bleeding from the eyes, mouth and fang-marks (where there was no local reaction), large bruises formed at injection sites, but no bruising was noted elsewhere. He remained unconscious, with a haemoglobin level of 9.5 g/dl and the blood incoagulable (the Lee-White venous clotting time exceeded 20 minutes). Urine was scanty, bloodstained and loaded with albumin. A diagnosis of boomslang bite with DIC, afibrinogenemia and haemorrhage was made.

The SAIMR in Johannesburg was approached immediately and, after the case had been described to Dr P. A. Christensen, a supply of specific boomslang antivenom was despatched by scheduled air service. The flight was cancelled due to bad weather, however, and a further supply sent 340 km by road arrived at 01h50 on 26 October 1978.

Meanwhile supportive therapy with 2 more units of fresh blood and 2 units of fresh frozen plasma maintained the haemoglobin level at 9.5 g/dl, despite continuous bleeding. The patient remained semicomatose, restless and oliguric, while the blood remained incoagulable.

At 86 hours after envenomation, 2 ampoules of specific boomslang antivenom were administered intravenously, with promethazine 25 mg and hydrocortisone 100 mg. Within 20 minutes he was highly febrile and dyspnoeic, but responded well to a further 100 mg hydrocortisone given intravenously and hexoprenaline.

Improvement was almost immediate. No further bleeding occurred. One more unit each of fresh blood and plasma was infused. Clotting times were measured hourly. After antivenom administration, clotting time was 7 minutes at 1 hour, 15 minutes at 6 hours, 7 minutes at 10 hours, while the prothrombin index at 10 hours was 70% and at 30 hours 94%, with the haemoglobin level 12.4 g/dl. The blood electrolytes were then normal and the serum urea level was 40 mg/dl.

Thirteen hours after antivenom had been given, the patient was fully conscious, there was no bleeding, he could see again, urinary output was 100 ml/h and the urine, although dark, was not bloodstained. At 30 hours a full history was obtained and on the 4th day only two 'black eyes' and a few bruises gave testimony to his ordeal. No delayed serum reaction occurred, and he was discharged well on the 13th day.

DISCUSSION

Diagnosis

The description of the snake and subsequent clinical course of events, with immediate response to specific boomslang antivenom, confirms that this was without reasonable doubt a boomslang bite. No other green arboreal snake causes this clinical picture.

Envenomation

The patient was a snake handler, confirming that this non-aggressive back-fanged snake bites virtually only when handled. As in all reported cases, the bite was on a small part of the hand and no local reaction occurred except bleeding from the fang-marks.

Bedside and Laboratory Investigations

What clinicians (and patients, for that matter) need most are simple bedside tests which serve as quick practical guides to progress and management. The simple Lee-White clotting time test, carried out at the bedside, is probably the most valuable. Frequent haemoglobin estimations give a useful guide for blood replacement. Urinary output and appearance must be monitored. Oliguria, haemoglobinuria, haematuria and albuminuria are easily recognized in the ward and give vital information.

Only at this stage are laboratory tests required. Where oliguria occurs, creatinine clearance, blood urea and electrolytes may be estimated daily. Liver function may be monitored by enzyme and serum bilirubin estimations. Estimations of fibrin degeneration products, (FDP), prothrombin index (PI), prothrombin thromboplastin time
Treatment

Specific boomslang antivenom should be administered as soon as possible. Despite many mistakes in diagnosis and management, the reported case illustrates the remarkable efficacy of the antiserum, even 86 hours after the bite. If D. typus bite is suspected, urgent contact should be made with the SAIMR at the address given above (see ‘Antivenom’) giving clear motivation.

Early reactions to the antivenom are frequent.7 Visser and Chapman1 advise a test dose of 0.1 ml subcutaneously (diluted 1/10 in sterile water), irrespective of atopic history. If no reaction occurs after 15 minutes, the dose should be doubled. If there is still no reaction, 20 ml antivenom should be cautiously injected intravenously, over 3 - 5 minutes. The dose may need to be repeated. Remember that a test dose often fails to reveal allergy.

This type of snakebite allows time for cautious approach. Keep at hand an injection of adrenaline, intravenous hydrocortisone, (or the more rapidly acting methylprednisolone hemisuccinate or dexamethasone phosphate), an injectable antihistaminic and a bronchodilator (e.g. hexophrenalin).

If a reaction occurs early after a test dose, a difficult problem arises. The brochure accompanying SAIMR antiserum advises only ‘the greatest caution’. Slow intravenous infusion of diluted antivenom (e.g. the required dose in 0.25 - 1 l of 0.9% saline or 5% dextrose), is said by Sutherland10 to reduce reactions greatly. Visser and Chapman mention progressive ‘desensitizing’ doses, but give no details. They also favour prior intravenous injection of an antihistaminic (e.g. promethazine 25 - 50 mg diluted to 10 or 20 ml) as an effective prophylactic, keeping adrenaline and hydrocortisone in reserve. Adrenaline 0.5 ml subcutaneously, repeated if necessary, is usually highly effective, provided contraindications are kept in mind.12

There is controversy regarding corticosteroids. While some advocate high doses (e.g. 0.5 - 5.0 g of hydrocortison or methylprednisolone hemisuccinate 10 - 30 mg/kg) routinely before antivenom is given, to prevent reactions,13 others warn that steroids are not always effective,14 may aggravate DIC and haemolysis15 and may increase venom toxicity.16,17 It seems wise, therefore, to keep corticosteroids at hand for use in cases where (a) an antihistaminic fails to prevent an early reaction and additional adrenaline fails to control such a reaction, or (b) the history, a test dose, or both, indicate that a severe reaction is to be expected.

Replacement of blood loss and fibrinogen by means of fresh whole blood and fresh frozen plasma, with additional fibrinogen (8 - 10 g per day), if available, is required as supportive treatment until the antivenom has been administered and takes effect.

Heparinization remains controversial.18 It is argued that administration of fibrinogen, pure or in blood or plasma, merely ‘feeds the fires’ of the coagulopathy and may increase organ damage unless heparin is given. Full heparinization is advocated on theoretical grounds, as in other instances of DIC, until the antivenom takes effect and fibrinogen returns to a safe level. A suggested regimen is 10 000 units of heparin initially, followed by either 7 500 units 6 - 8-hourly intravenously or 1 000 units hourly in a drip infusion.

Two fairly recent reports4,14 describe the use of heparin in boomslang bite. In one report6 the dose given was very low, and started 3 hours before antivenom was given; in the other15 dosage was adequate, but was stopped immediately antivenom was given. The writers observe that while heparin produced little obvious improvement, there was a rapid response to antivenom. They say that, conceivably, heparin reduced damage to the kidneys.

Probably, therefore, full heparinization may be justified where good laboratory facilities are available, particularly if the doctor has experience in the management of DIC. It is a courageous step to take when a patient is bleeding from every orifice.

Other measures. Incision of fang marks is now generally discouraged. Immediate suction at the site may remove some venom, although this is difficult to prove. A tight arterial tourniquet, considered useful for rapidly acting front-fanged elapid bites (e.g. cobra or mamba)19 seems unlikely to help in boomslang bite because the venom acts so slowly and arrival of antivenom will be delayed far beyond the time limits of any tourniquet.

CONCLUSION

Administration of specific boomslang antivenom at the earliest possible moment is the keystone to successful treatment and rapid recovery. All other measures are supportive.

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