Approach to the diagnosis and management of snakebite envenomation in South Africa in humans: Special patient groups and surgical aspects

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This article explores the management of snakebite in vulnerable patient groups, namely children and pregnant women, as well as providing detail on the current best practice when caring for venom ophthalmia and surgical wounds resulting from snakebite. Finally, the optimal free-to-use medical record for accurate documentation of snakebite incidents is provided for use by South African practitioners.

Snakebite is not only confined to the adult population, but children and even pregnant women are at risk, although the latter are uncommonly bitten. Venom ophthalmapathy is painful, and found after venom ‘spitting’ by the spitting cobra groups. Cytotoxic bites may lead to extensive swelling or areas of tissue necrosis, and as such, the emergency unit may refer the patient to a surgeon for assessment. This article addresses these patient groups and the current best practice of eye care, wound care and surgical management. It also provides a useful set of clinical records to use during the management of snakebite presentations approved by the South African Snakebite Symposium (SASS), held in Nelspruit on 29 and 30 July 2022.

Special aspects regarding snakebite in children

Owing to their smaller size, children may present with more severe effects after snakebite, due to their lower volume of distribution relative to the injected venom mass. This higher venom-to-body-mass ratio can produce rapid and severe neurotoxicity, coagulopathy and extensive local tissue damage.11

While children are not small adults, it is important to treat the child with a higher index of suspicion, and importantly, the same dose of antivenom as in adults must be administered when indicated.11-13 Adrenalin pre-dosing prophylaxis is given at 0.01 mg/kg, to a maximum of 0.25 mg.12 General treatment is as for adults, with early airway and ventilatory support, renal support and close observation. Antibiotics are controversial, and should only be given for infected cytotoxic bites, as a rule.14 Antivenom reactions are common and should be treated using an anaphylaxis protocol, which includes the use of intramuscular adrenaline, antihistamines and steroids.3,5,6 Mortality from antivenom reactions is low.1,3,6 As for adults, there is a risk for delayed serum sickness 5 – 25 days post antivenom, and this responds well to oral steroids.1

Snakebite in pregnancy

Snakebites in pregnancy are fortunately rare, with very few case reports in the world literature, and only two from SA.15,16 While there appears to be a higher risk for fetal loss in the first and early second trimester (up to 40%), the approach and treatment should follow the usual methods as detailed for adults.15,16 Spontaneous abortion is common in early pregnancy; however, excessive bleeding is not, possibly owing to muscle contractions from the venom. Slowing of fetal movements and heart rate has been described, and cardiotocography is advised. Vasopressors and inotropes should be avoided in pregnancy.15 The risk for teratogenicity is low.15 In advanced pregnancy, left lateral positioning is preferred to ensure uterine perfusion.15

Venom ophthalmia

The ‘spitting cobras’ and rinkhals can direct venom streams toward the eyes of the person or animal threatening them, and this leads to a painful rapid-onset ophthalmia. Treatment is directed at prevention of complications. The practice of applying antivenom into the eye has not been proven to be effective.5

- Flush the affected eye/eyes with water or a balanced salt solution.
- If a local anaesthetic agent is available, add 2% lignocaine 1 mL/1 000 mL saline.
- Add a mydriatic eye drop in cases where corneal damage is noted.
- Do a slit lamp fluorescein check for corneal damage and cover with antibiotic drops for 5 days.

Refer to an ophthalmologist for daily slit lamp examinations.

Surgical and wound management

Local wound care is usually all that is required in the first 24 – 48 hours post bite.1,3,14-12

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**SNAKEBITE TARGETED HISTORY**

<table>
<thead>
<tr>
<th>Body Part Bitten</th>
<th>FRONT</th>
<th>BACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Bitten</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current location of snake</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description of the snake**
- Dark brown
- Blowing sound (Adder)
- Characteristic hood & hiss (Cobra)
- Green in colour
- Light brown
- Spotted
- Black
- Small head
- Large head

Other:

**Type of snake (if known)**

**Signs & Symptoms**

- **Cytotoxic Bites:**
  - Pain
  - Swelling
  - Discolouration

- **Neurotoxic Bites:**
  - Metallic Taste
  - Slurry Speech
  - Ptosis (Difficulty Opening Eyes)

- **Haemotoxic Bites:**
  - Drowsiness
  - Weakness
  - Respiratory Difficulty

- **Bleeding (Site / Anywhere Else)**
  - Other: Specify

**Previous snakebites**
- Yes
- No

**Received Antivenom**
- Yes
- No

**Abnormal Reaction / Anaphylaxis after receiving antivenom**
- Yes
- No

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**Disclaimer:**

The authors and editor have exerted every effort to ensure that the clinical procedures and recommendations described herein are based on current knowledge and state of the art. Information obtained from acknowledged authorities, texts and journals. However, they cannot be considered absolute and universal recommendations. Each patient situation must be considered individually. The reader is urged to check the package inserts of drugs and equipment and the manufacturer’s recommendations for indications, contraindications, proper usage, warnings and precautions before use. The authors and editor disclaim responsibility for any adverse effects resulting directly or indirectly from information presented in this booklet; untested errors or misunderstandings by the reader.

This Original Nelspruit Emergency Department Snakebite Management Pathway (ISO ED 11077/3P Nov 2019) has been adapted and updated for The South African Snakebite Symposium 2022 as: Snakebite Management: A South African Consensus Guideline 2022.

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**Fig. 1A. Snakebite care pathway and medical records (4-page document).**
FOCUSED PHYSICAL ASSESSMENT BY TRAUMA TEAM

Assessment should be focused on deciding if a significant envenomation has occurred and differentiating which envenomation syndrome is presenting:

**PPS** (spitting cobras, puff adder, gaboon adder) - look for the rate of swelling, progression, discoloration and blistering at the site.

Mild to moderate swelling - Stiletto snakes/night adders - cause less swelling with potential local damage but only needs conservative treatment.

**PW** (mambas, non spitting cobras) - any neurological sign is a medical emergency as it may lead to respiratory arrest. Early signs are metallic taste, parasthesia, blurred vision with ptosis, difficult speech and swallowing. Patient may have a "drunk" appearance. Full preparation for intubation and ventilation should be made if any of these signs are present.

**Bleeding** (boomslang, vine snake) - may take many hours to develop, thus cautious monitoring is essential. Bleeding from the bite site and oropharyngeal area (gums) are often the first signs. 20 minute Clotting test is positive in these patients.

Draw a ring around the bite area with a permanent marker pen and record the time inside the drawn ring.

Monitor every 30 minutes for progression of symptoms and swelling of the area.

Examine the patient for tooth and fang marks or even tiny scratch (Boom slang or Black mamba)

<table>
<thead>
<tr>
<th>Local Signs</th>
<th>Swelling</th>
<th>Persistent Bleeding</th>
<th>Discolouration / Blistering</th>
<th>Other</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Systemic Signs</th>
<th>Neurotoxic / Paralysis</th>
<th>Cardiovascular Instability</th>
</tr>
</thead>
</table>

**ALLERGY PROFILE**

- Any medication allergy? [ ] Yes [ ] No
- Have you had antivenom treatment before? [ ] Yes [ ] No
- Do you suffer from asthma or hay fever? [ ] Yes [ ] No
- Have you had infantile eczema? [ ] Yes [ ] No
- Any other allergies, e.g. food (peanuts) or bee stings? [ ] Yes [ ] No
- Have you ever been bitten by a snake before? [ ] Yes [ ] No

If any of the answers above are Yes – Prepare for High Possibility of Anaphylaxis

**MEDICATION PRESCRIPTION AND ADMINISTRATION**

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Dose</th>
<th>Route</th>
<th>Site</th>
<th>Time</th>
<th>Signature</th>
</tr>
</thead>
</table>

**Prescribing Dr**

Signature

PPS: Painful Progressive Swelling

PW: Progressive Weakening

B: Bleeding

Fig. 1B.
Fig. 1C.
Fig. 1D.
Most cases of cytotoxic bites will result in some degree of tissue inflammation, and often eventual necrosis. In the early phase of care, blisters and tense bullae can be left alone if the skin is intact and imminent rupture unlikely. However, blisters that have already ruptured should be debrided and cleaned with a chlorhexidine-based antiseptic solution, then covered with a silver or honey-based dressing.

Other blisters are best allowed to mature for ~48 hours, and then may be debrided to clean edges, similar to deep partial burn wounds. These are then covered with a dressing containing silver-based products (or honey-based products), as infection prophylaxis. Suitable absorbent material is used to provide top cover to ensure a moist non-sloughy wound bed.

The wounds are re-assessed after 48 hours, and if infected, debrided, and abscesses drained. Antibiotics are not used prophylactically and are given on indication after wound cultures if the patient has systemic signs.[11,12] Non-septic, necrotic wounds should be left for 5 - 7 days to demarcate before conservative debridement to healthy bleeding tissue is performed.[11,14,15] The use of negative-pressure wound care devices may be beneficial, if available. [11] Finally, skin grafts may be necessary after some time, but should not be performed before ~10 days post bite.[11,13,14]

Before discharge, patients should be referred to physiotherapy and occupational therapy for rehabilitation of the affected limb if swollen, or where skin grafts have been performed. This will entail motor functional retraining and possibly the use of compression garments for scar maturation.

**Pseudo-compartment syndrome**

True compartment syndrome is extremely rare in snakebites. The swelling seen in cytotoxic bites is localised to the subcutaneous tissues, as seen on ultrasound studies of patients bitten in KwaZulu-Natal Province.[11] The misleading clinical appearance of pseudo-compartment syndrome is unfortunately the reason that many unnecessary fasciotomies are performed. Pain, pallor, tense swelling, pain on passive stretch and absent pulses may be found in pseudo-compartment syndrome. A key distinguishing feature of pseudo-compartment syndrome is that pressures when measured with a Stryker or similar self-made pressure monitoring device are ~30 -40 mmHg. While not yet standard of care, ultrasound studies have been shown to be useful in avoiding unnecessary fasciotomy, and are given on indication after wound cultures if the patient has systemic signs. [11,12] Non-septic, necrotic wounds should be left for 5 - 7 days to demarcate before conservative debridement to healthy bleeding tissue is performed. [11,14,15] The use of negative-pressure wound care devices may be beneficial, if available. [11] Finally, skin grafts may be necessary after some time, but should not be performed before ~10 days post bite. [11,13,14]

Animal studies have demonstrated that fasciotomy is ineffective in saving envenomed muscles.[12,13] The venom affects the muscle primarily, and this leads to delayed recovery, with or without fasciotomy. [12,13,14,15] Medical treatment with aggressive elevation of the affected limb above the level of the heart, antivenom administration at the high end of the dose range for painful progressive swelling including 2-hourly follow up doses and the administration of osmotic diuretics can prevent the vast majority of fasciotomies and must be completed prior to fasciotomy with re-assessment of the limb.[11,13] The rare occasion of a true compartment syndrome is usually associated with prolonged tourniquet use, delayed presentation to hospital and lack of antivenom use.

**Medical records**

Documentation of snakebite care is an important medicolegal aspect. The emergency unit flowchart that was adapted (with permission from the Netcare group) to include the recent developments in snakebite treatment will ensure that no important decisions are missed or incorrect therapy is offered, with timely investigations and treatment (see Fig. 1 – a 4-page document for recording the management of snakebite victims).

**Conclusion**

Most morbidity related to snakebites and the associated serious sequelae are largely preventable, provided there is suitable care for venom ophthalmopathy and conservative surgical wound care, and if the specific needs of children, the most neglected snakebite group, and on rare occasions pregnant women, are taken into consideration.[16]

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