Snakebite envenoming: Pocket guide MSF OCG

Adapted[1] to the change of antivenoms in July 2016

This is a pocket clinical guide, it does not replace the full guidelines (WHO, MSF), for South Sudan and neighbouring countries

1. OVERVIEW OF THE 3 MAIN SYNDROMS

Syndroms	**Painful progressive swelling, necrosis = cytotoxic**	**'Viperid syndrome' Bleeding, non-clotting = haemotoxic**	**'Elapid syndrome' Progressive weakness & paralysis = neurotoxic**
Species	Vipers *Bitis & Echis* + Spitting cobra *N. nigricollis* *Other vipers & colubrids*	Most *Echis* carpet vipers, Some *Bitis* adder-vipers; Rarely Boomslangs	Egyptian Cobra *Naja haje*, Black Mamba *Dendroaspis polylepis* & others (green…)
Mild → *no antivenom needed*	No extension, local, not finger-toe*, face-neck**		
Severe envenoming anticipated → *give antivenom*	Systemic signs: Hypotension, tachycardia, vomiting, diarrhoea, thoracic pain		
	Rapid extension of swelling > 15 cm/hour or face or neck (*limb-threat: finger or toe)	Prolonged bleeding from fang punctures or wounds; or gums/mouth	Paraesthesia, excessive sweating, salivation, strange taste, myosis
	Swelling to knee/ elbow at 4 hrs post-bite	severe headache, dizzy	Bilateral ptosis (droopy eyelids), difficult speech
Severe, life-threatening envenoming present → *give antivenom and support vitals*	**Swelling of whole limb**	**Positive clotting test (20'WBCT non-clotted)**	**Trismus, shortness of breath - respiratory paralysis**
	Swelling threatening airway, shock	**Spontaneous bleeding, shock, convulsions**	**Respiratory failure, Hypoxia**

*risk of amputation, **risk of threat to airways

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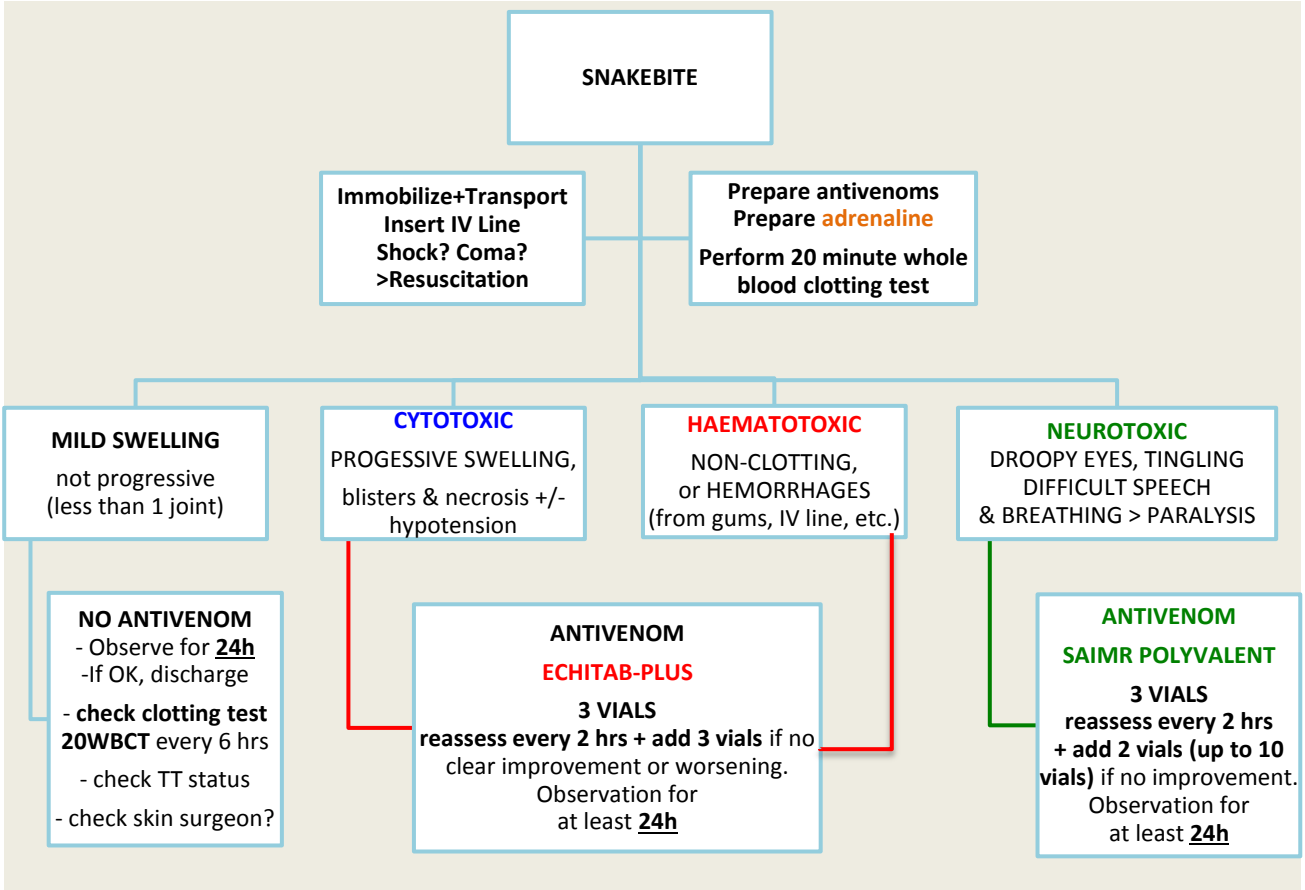
2. ANTIVENOM DECISION TREE



3. RAPID ASSESSMENT AND RESUSCITATION

I. When a patient arrives with severe envenoming, **resuscitation** may be needed. This is an emergency and the normal A-B-C-D approach is applicable:

Airway free

In case of abundant secretions threatening the airways (cobra bites) use atropine 0.6 mg in adults (0.05mg/kg in children).

In case of vomiting, consider anti-emetic e.g. metoclopramide slow IV : adult 10mg, children: no metoclopramide; if severe vomiting in children give odansetron 0.15 mg/kg (max 4 mg) single dose.

Breathing secured

Exclude respiratory paralysis from neurotoxic envenoming; endo-tracheal intubation may be

needed (laryngeal mask if trained personnel/anaesthetist available, otherwise ambu bag ventilation). Anticipate respiratory failure in case of eyelid ptosis (neurotoxic syndrome).

Circulation appropriate

Hypotension / shock treated: Insert one large bore IV cannula (carefully as bleeding risk) and infuse IV Ringer solution: → Adults: 1000 ml (Children: 20 ml/kg), stat./over 5-10 min. Then start a standard needs infusion. Some types of envenoming can cause a capillary-leak syndrome, progressive endothelial damage, or progressive internal bleeding → hypotension & shock can occur progressively, keep measuring vitals hourly for about 4 hours then every 2 hours for 12h then every 4 hours : Capillary refill time (CRT), Pulse, RR, BP, SatO2%.

Disability

The level of consciousness should be assessed using the A-V-P-U system (A: alert, V: responds to voice, P: responds to pain, U: unresponsive = coma).
D': Evaluate pain: use Paracetamol and/or Mild Opioids (e.g. tramadol or codein) but NO NSAIDS (e.g. ibuprofen) and NO aspirin because of the risk of bleeding.

II. **An IV line should be inserted for all patients** after snakebite, even if resuscitation is not needed as severe complications can occur many hours later. However, aside from maintaining IV access, try to avoid any unnecessary veni-punctures due to potential bleeding risks.

III. **20'WBCT should be performed for ALL victims**, as soon as possible = as soon as the patient is stabilised, because it is the best diagnostic test for *Echis*, and it allows to anticipate severe haemotoxicity.

IV. Local examination

- Check the level of swelling (in cm) and write it in the chart 1x/hour AND write a line on the patient **skin** at the limit of the swelling every hour.
- Clean & disinfect the wound.
- Elevate the swollen limb.

Hb (hemocue) can be useful in case of haemorrhage to evaluate the needs of transfusion, but is not necessary in most cases.

If you are still in the field, pre-hospital:

Make sure you and the victim are out of the snake's defensive range. Don't try to kill the snake.

- Re-assure the patient, and yourself.
- Take the patient's pulse and check responsiveness, breathing, bleeding?

- **Remove rings, bracelets, and tight clothes.**
- Apply a bandage (5x5x10cm) pad on the wound, NO TOURNIQUET, to reduce venom diffusion BUT keeping a good distal arterial pulse (podal or radial).
- Immobilise using a long stick and a splint.
- Transport as quickly as possible to the closest facility with antivenom and keep the patient immobile (or at least immobilize the limb involved using a basic splint).

4. ADMINISTRATION OF SNAKE ANTI-VENOM AND DEALING WITH SIDE-EFFECTS

When administering snake anti-venom, always be prepared to treat an anaphylactic reaction. Prepare 1) anti-venom and 2) drugs and material for anaphylactic reaction.

1) Anti-venom should be given by the intravenous route **(IV)**. The prescription on the anti-venom package should be followed; for adults and children.

Administration:

- Anti-venom (10 ml) can be given direct IV (reconstituted, but undiluted) over 10 - 15 minutes NOT FASTER due to the risk of anaphylaxis,
- or by intra-venous infusion over 30 minutes after diluting in sodium chloride 0.9 % or another isotonic IV fluid (use **5 ml diluent/kg bodyweight**).
- Only in VERY exceptional and life saving circumstances can anti-venom be given intramuscularly; it should then be given in anterior thighs, NOT gluteal region. IM injection should be followed by massage to increase absorption.
- The advantage of direct IV is that the health care worker is present at the moment of administering and taking care of side reactions.
- The diluted method is often recommended, especially in case of expected risk of poor purification of the anti-venom.

2) Prepare epinephrine (adrenaline) 0.5 ml 0.1% (1mg/ml) or 0.01 mg/kg for children (see table above). Have means ready for respiratory support: **ambu-bag, airway guedell**, if possible (and if experienced operator available) (equipment for endo-tracheal intubation rarely possible → only if anaesthetist/intensivist is available.

- Infusion should be started slowly while reaction in patient is observed: rash, tachycardia, drop in blood pressure, coughing, bronchospasm, pruritus (nasal, eyes), and sweating, abdominal pain, faecal or urinary urgency.
- Mild reactions might resolve by a short stop of administration.
- Management of severe reactions (bronchospasm, sudden hypotension):
    - suspend anti-venom infusion
    - lay patient horizontally
    - if available support with oxygen

- rapid infusion of 1 litre Ringers over 5 minutes (20 ml/kg children)
- inject epinephrine (adrenaline)
- If patient does not improve: repeat sodium chloride bolus infusion, repeat epinephrine (adrenaline)

Dosage of the 2 antivenoms introduced in Agok and Mayom :

ECHITAB-PLUS (ICP)

- Initial dose should be **3 vials (30 ml)**
- Further doses can be another 3 vials at 1 hour, and again after 2-6 hours; e.g. in case of severe bleeding, or life-threatening swelling, or hypotension.
- Can be given as a direct SLOW IV in 10-15 min, NOT FASTER.
- Preferably infuse over 1hour (in 500 ml normal saline for adults, 200 ml for children): this allows checking for adverse reactions. If no SAE have occurred during the initial 20 minutes you can accelerate the infusion (drip speed) to complete the full infusion in 1 hour.

SAIMR-POLYVALENT (SAVP)

- Initial dose should be **3 vials (30 ml)** *(up to 5-10 vials WHO guidelines for black mamba bites; only 2 vials according to SAVP)
- Further doses can be another 3 vials (**up to 10 vials for black mamba bites**) after 30 minutes in case of neurotoxic bites not responding to first 3 vials.
- Can be given as a direct SLOW IV
- Preferably infuse over 10 minutes (3 vials in 500 ml normal saline for adults, 100 ml for children)

EXPECTED RESPONSE TO ANTIVENOM: usually the response is quick if dosage is sufficient e.g.:

- **Hypotension and bradycardia (**after *Bitis arietans*) **should disappear after 20 minutes**;
- **Spontaneous bleeding should stop after 15-30 minutes;**
- **Clotting test should be normalised after 6 hours.**
- IF THIS IS NOT THE CASE REPEATED DOSES ARE NEEDED.
- For neurotoxic cases, respiratory support (manual bag mask ventilation) can be necessary for several hours despite large amounts of antivenom. Ptosis & paralysis are not reversed immediately.

NOTA BENE:

1. Dosages for treatment with anti-venom are not standardised: dosages therefore differ depending on the producer. Treatment protocols have to be adapted to the locally available anti-venom.
2. Children require the same dosage as adults, as the amount of venom injected by the snake is the same as in adults.
3. In general: minimum dose is at least **3 vials** of appropriate anti-venom (EchitabPlus or SAIMR-polyvalent), however for some anti-venoms the starting dose is higher; it can be

higher when severe envenomation is suspected (multiple bites, rapid onset).The dosage can be repeated after 1-2 hours if symptoms of systemic envenomation persist.

4. Observe not only clinical signs and symptoms, but clotting status as well (repeat clotting test after 6 hours). In case of severe continuation of bleeding one should not wait 6 hours, but an extra dose of anti- venom should be given (at 1-2 hours).

Additional treatments

Pain management:

- Paracetamol is preferred or small doses of morphine (be careful in neurotoxic envenomation).
- NSAIDs or ASA are contra-indicated.

Antibiotics:

- Infection rate is low unless the wound has been tampered with or there is already tissue necrosis: there is **no place for routine systematic prophylactic antibiotics**.
- If the wound is necrotic, Clostridium tetani should be eliminated with a large dose of benzyl penicillin or metronidazole and an aminoglycoside such as gentamicin should be given for 48 h.
- If a local abscess develops, it should be drained and penicillin, chloramphenicol, or erythromycin given.

Vaccination:

- A booster dose of tetanus toxoid should be given.

Neostigmine:

Neostigmine can reduce the activity of the venom of several neurotoxic snakes. Based on this principle an anti-cholinesterase test can be done for all patients with neurotoxic symptoms with the exception of those bitten by a mamba. The venom of mamba contains an anti-cholinesterase so the test should not be administered. This test (especially in our settings) might spare the need for intubation and mechanical ventilation, or even save lives. Literature (1988, 1989) supports this test, especially for Asian/African neurotoxic cobra bites.

1) Record patient (neurological) status
2) Atropine 0.6 mg IV (children 50 µg/kg bodyweight)
3) Neostigmine 2.5 mg slow IV (paediatrics use 50mcg/kg, max 2.5 mg)
4) Observe patient 1 hour for improvements (e.g. reduction of ptosis or improvement in ventilatory capacity).

If anti-cholinesterase test is positive:

- Neostigmine per infusion 25-100 µg/kg/hr up to maximum 10mg/24 hours.
- Alternately, neostigmine may be administered by subcutaneous injection, 0.5 mg -2.5 mg every 1-3h, again to maximum 10mg/24 hours.
- Children can receive 0.01-0.04 mg/kg q2-4 hours.
- Plus Atropine 0.6 mg IV 4-6 hourly

Conservative treatment **without** anti-venom:
Due to the current, worldwide shortage of anti-venoms (in quantity and in quality), safe supplies of anti- venom in many areas might not be available. It probably depends on the capacity of the health facility (and – workers) regarding what treatments are possible.

- In case of respiratory paralysis: As (respiratory) paralysis is reversible in time, prolonged mechanically ventilation (including manually) can save someone's life, even in the absence of anti-venom. Endotracheal intubation is needed.
- If neostigmine and atropine are available always try anti-cholinesterase test in case of neurotoxic envenomation.
- In case of coagulation disorders: Avoid all trauma, **bed rest indicated**. **Fresh whole blood** to control active bleeding.
- Hypotension should be treated with infusions & boluses (Ringer) as explained above.
- Hypotension derived from bradycardia should be treated with **atropine**.

Admission and follow up/monitoring
Patients should be observed at least **24 hours** after a snake bite.
Monitoring depends on initial pathology:
- When anti-venom is given close monitoring for at least an hour is needed
- For local symptoms: measure circumference of bitten body parts, lymph nodes, developing necrosis, intra-compartmental syndrome
- Systemic: follow up on blood pressure, heart rate, respiratory system, temperature, abdominal pain, vomiting
    - Paralytic signs
    - Urine production
    - Blood coagulation – oozing, haematuria, active bleeding
    - Clotting test, other laboratory tests

5. SEVERE ADVERSE REACTIONS (SAE)

Severe adverse reactions (SAE) due to antivenom are frequent and of 3 types:

1. Anaphylactic reactions (urticaria, asthma, shock): immediate reactions within 30'-2hrs
Immediately administer:

For severe anaphylaxis (shock or respiratory distress, asthma):

Epinephrine (adrenaline) 0.5 ml 0.1 % (child: 0.01 mg/kg) intramuscular if conscious (avoid IM if bleeding) and IV in case of resuscitation. S/C route preventive half-dose adrenaline is possible if allergic risk is anticipated: victims with previous allergic reactions to antivenom, serums, vaccines, or multi-trigger asthma.

+ Bolus of Ringer-lactate (adults 1000 ml , children 20ml/kg) as fast as possible (5-10 min) in case of confirmed shock with hypotension or delayed CRT(>2 sec) or loss of consciousness.

Dosage of epinephrine

Dosage for epinephrine intramuscular injection for anaphylactic shock - 1 : 1000 (1 mg/ml)		
Age	Dose	Volume of epinephrine
Child < 6 years Child 6 – 12yrs Adult and child 12 – 18 yrs	120 micrograms (µg) 250 µg 500 µg	0.12 ml 0.25 ml 0.5 ml
Use a 1 ml syringe graduated in 0.1 ml Dosages might be repeated several times with 5 minutes interval according to blood pressure, pulse, and respiratory function. If circulatory collapse or deterioration after i.m., give by intravenous route diluting dosage as per instructions in Essential Drugs.		

Adjunctive treatment and initial treatment for mild-moderate reactions:

Promethazine (25 mg/ml) : adult and child > 10 years: 25 to 50 mg i.m. / child (5-10 yrs) 12.5 mg i.m.

Hydrocortisone (sodium succinate): adult: 200 mg / child: 2 mg/kg bodyweight. Dissolve 100 mg in 2 ml water for injection and administer by i.m injection or slow i.v. push

In case of persistent bronchospasm:

Salbutamol 100mcg / metered inhalation – **2-4 puffs** (1-2 puffs for young children) **every 10 – 30 minutes** depending on severity. Consider use of spacer device.

2. Pyrogenic reaction: other early reactions (usually 1 – 2 hours after treatment) are the pyrogenic reactions: high fever, rigors, febrile convulsions (children), lowering of blood pressure after 1-2 hrs after administration of anti-venom, caused by contamination products in the anti-venom. **Paracetamol** should be administered, combined with cooling of the patient.

3. Late serum sickness: Late serum sickness can start about 3 to 28 days (average 1 wk) after treatment; this reaction is related to the dose of anti-venom. The clinical symptoms vary widely: fever, rash, arthralgias, lymphadenopathy. Treatment:

Antihistamine: **chlorpheniramine** 4mg tablets Adult 4mg every 4-6 hours Max 24mg/day. Child: See Essential Drugs for dosages

In severe cases or therapy resistant: **prednisolone** 50mg/day for 5 days (adults), 0.5-1.0 mg/kg/day children for 5 days

6. LOCAL COMPLICATIONS

Compartment syndrome is a relatively rare complication of viper envenomation. It can be confused with **muscle damage** due to direct effects of the venom.

Signs of compartmental syndrome include:

- Tightness of the compartment, pain, paralysis/paresis of the muscles, and altered sensation.
- Pain is out of proportion to the injury and is exacerbated by passive movement of the muscles involved in the affected compartment.

Confirmation requires measurement of intra-compartmental pressure which is not often available in MSF settings. Where compartment syndrome is suspected, a surgeon should be consulted urgently to determine if **fasciotomy** is indicated. Surgical decompression can only be done when coagulation disorders are corrected. Early treatment with anti-venom is best way to prevent compartment syndrome: fasciotomy should be avoided as much as possible as it can be a destructive procedure, depending on the surgeon's experience.

7. SPECIAL CASES

Pregnant (and lactating) women

Envenomed pregnant women are at risk of fetal distress, premature labour, ante and post-partum bleeding and stillbirth. Observe for bleeding disorders and fetal distress. Fetal bradycardia may indicate fetal envenomation due to cross placental transmission. Anti-venom treatment is indicated as it outweighs the risk of anaphylaxis. If severe anaphylaxis does occur in response to anti-venom, epinephrine should be used in this situation.
Lactating women may continue breast feeding after a snake bite.

Spitting cobra: eye lesions

Eye lesions can occur due to spitting venom (spitting cobra). Pain, oedema, eyelid spasms may also occur. In more than 50 % of cases cornea lesions occur (detection with fluorescein staining, blue light), and occasionally loss of sight.
First Aid:

- fluid irrigation in eyes (use plenty of water!)

Pain relief:

- tropicamide 0.5% eye drops – mydriatic, cycloplegic

Treatment:

- topical antimicrobials (Tetracycline 1% eye ointment or Chloramphenicol 0.5% eye drops) to prevent ophthalmitis. A dressing pad can be applied.
- Anti-venom is not required.

8. PREVENTION

Snake bites cannot be avoided completely, but risk can be reduced through knowledge and appropriate behaviour. All MSF staff should be made aware of risk reduction, including environmental measures. These measures can also be part of health education messages for target population:

1. Vigilance during night, after rain/flooding
2. Proper **shoes/boots** when in field -> rubber boot distributions?
3. Use of **light** at night
4. Avoid sleeping on ground -> use **mosquito nets** for children at least
5. Avoid rubbish or food on compound (with mice/rats), termite mounds, domestic animals (e.g. chickens) as all this attracts snakes (some other animals can protect against snakes)
6. Grass should be cut short on compound (house and clinics)
7. Avoid types of house construction that are 'snake prone' (straw walls, cracks etc)
8. No barehanded touching of apparently dead snakes (bite reflex can remain until one hour after death) – be careful in removal
9. Careful with swimming in certain areas and sorting your fish (water snakes)

9. ANNEXES

MEDECINS SANS FRONTIERES
ÄRZTE OHNE GRENZEN

Annex 1: Snake photo-album for each country

Annex 2: "Kit" for snakebite envenoming (adapted from WHO 2010 guideline):

1. Antivenom EchiTabPlus AND SAIMR-Polyvalent (replacing Sanofi Fav-Afrique)
2. Tetanus toxoid
3. Epinephrine (adrenaline) injection 0.1% (1:1,000) (1 mg/ml)
4. Parenteral antihistamine and hydrocortisone
5. Pain killers e.g. paracetamol and codeine/tramadol NOT aspirin NOT nonsteroidal anti-inflammatory (ie NOT ibuprofen)
6. Antipyretics (paracetamol tablets, syrups and suppositories)
7. Local anaesthetic agents (e.g. 1-2% lidocaine)
8. Intravenous (IV) cristalloid fluids e.g. Ringer lactate OR normal saline (0.9% NaCl)
9. Atropine and neostigmine (Prostigmin) for "Tension Test"
10. Metoclopramide and odansetron for vomiting
11. Fresh (<12h) blood transfusion collection kit (to substitute depleted coagulation factors AND fridge to store it.
12. Oxygen concentrator OR cylinders with spanners, gauges, connectors
13. Antibiotics (e.g. Co-Amoxiclav, metronidazole, gentamicin)
14. Ambu bag
15. Face masks and oral airways (Guedel)
16. Suction apparatus and catheters
17. Urine dip sticks
18. New, clean, dry glass vessels for 20WBCT
19. Syringes, needles, intravenous cannulae
20. IV administration set
21. Sticking plaster
22. Scissors
23. Splints
24. Bathroom type weighing scales (weigh 1x/day if severe swelling)
25. Stretchy, elasticated crepe bandage and splint