

# SNAKE POISONING & ENVENOMING MANAGEMENT

**TARUN GAMBHIR**  
**ROLL NO:108**



# GENERAL OVERVIEW

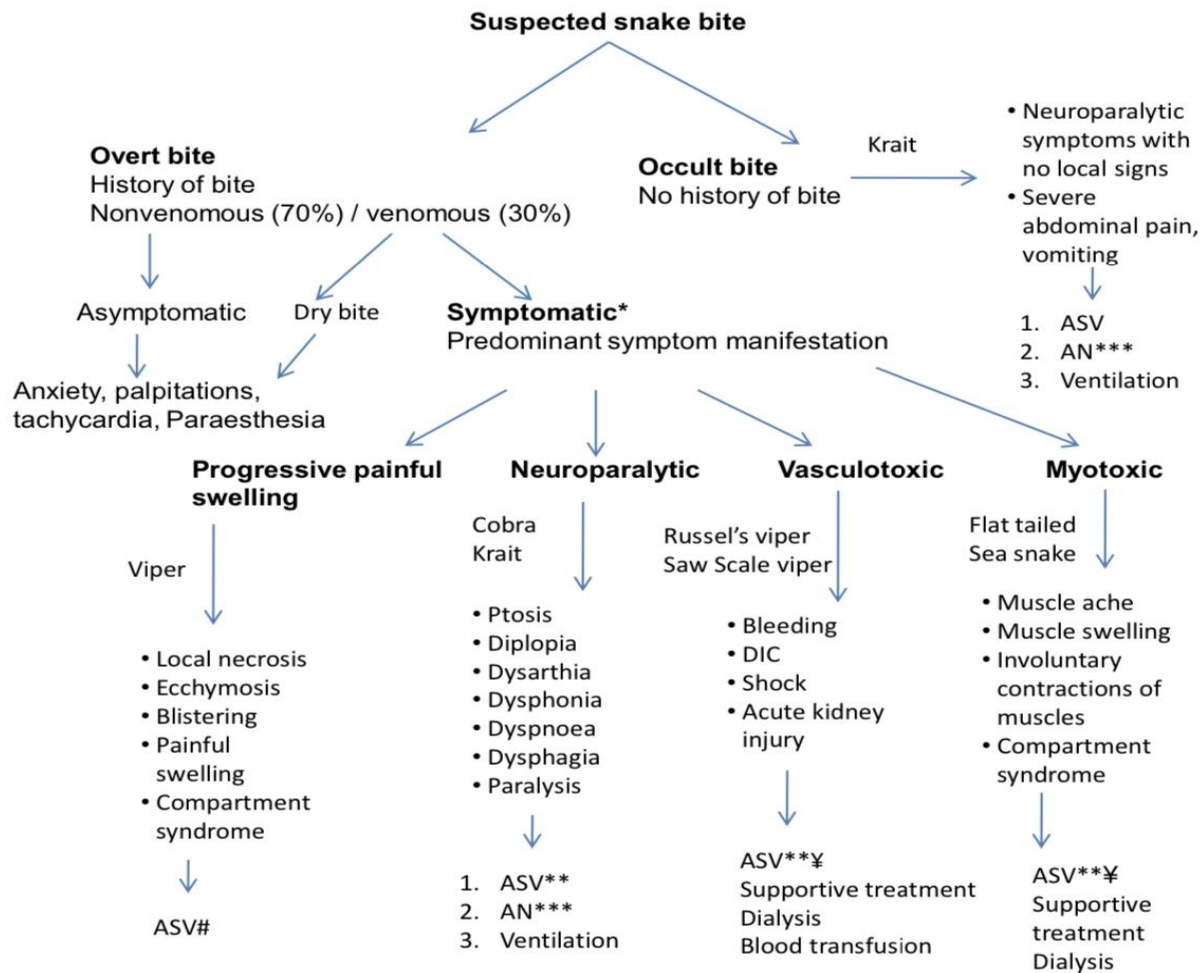
- **Venom Usage:** Snakes use venom for prey capture or self-defense.
- Venom is produced at a high metabolic cost and is used sparingly.
- Some bites are **dry bites (no venom injected)**, which is crucial in management.
- Snake Bites can cause varied effects, including local, systemic, and specific toxic effects.

# EPIDEMIOLOGY

- **Global Incidence:** Annually, 1.2–5.5 million snake bites occur worldwide, leading to 421,000–1,841,000 envenomations and 20,000–94,000 deaths.
- Accidental envenoming is common in rural tropics but can occur anywhere, including from exotic venomous pets.
- **High-Risk Areas:** Bite rates are highest in temperate and tropical regions, particularly among populations engaged in manual agriculture and fishing.
- **Identification Challenge:** Differentiating venomous from non venomous snakes is difficult, as color patterns can be misleading.

# PROGNOSIS

- Mortality rate in the U.S. is  $<1\%$  for those receiving antivenom.
- Permanent functional loss in the affected limb is a significant risk.



# CLINICAL EFFECTS OF SNAKE ENVENOMING

- Snake venoms contain enzymes and toxins that cause:
- Vascular leakage
- Tissue necrosis
- Coagulation disorders
- Organ dysfunction
- **Other Symptoms:**
- Hypotension
- Pulmonary edema
- Hemorrhage
- Altered mental status
- Paralysis (including respiratory muscles)

## LOCAL EFFECTS :

- Pain (mild to severe)
- Swelling
- Tissue necrosis (severe cases)

## SYSTEMIC EFFECTS :

- Headache, nausea
- Shock, collapse
- Seizures, cardiac arrest
- Specific Systemic Effects (Toxin-Dependent):
- **Neurotoxic**: Flaccid paralysis, autonomic dysfunction
- **Cardiotoxic**: Non-specific effects on the heart
- **Myotoxic**: Muscle pain, myoglobinuria, renal failure, elevated CK
- **Renotoxic**: Kidney damage due to hypotension, myoglobin, or direct toxin action
- **Coagulopathy**: Bruising, bleeding, thrombosis
- **Necrotoxins**: Cause tissue necrosis
- **Allergenic**: May trigger anaphylaxis

# 1. Local Effects

- Can range from trivial to severe.
- Some bites may cause minimal or no local effects but still result in lethal systemic envenoming.
- Some species exhibit predominantly local effects, while others show both local and systemic effects.

# 2. General Systemic Effects

- Shock is a critical complication in some snakebites, especially dangerous in children.

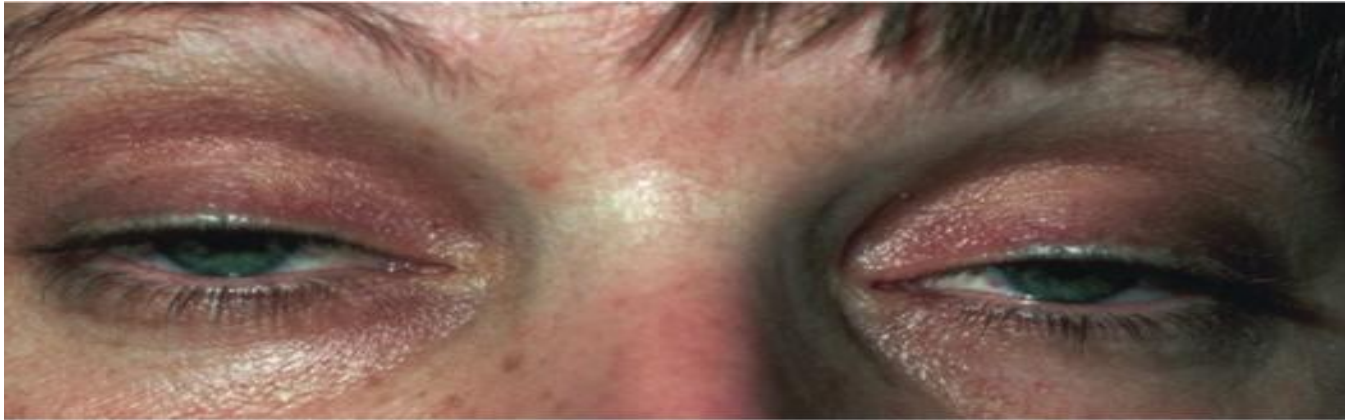


**Fig. 9.7** Ptosis following neurotoxin envenomation.

### 3. Specific Systemic Effects

- **Neurotoxic paralysis**

- Rapid progression in some cases or slower onset (some snakes).
- Typically starts with cranial nerve involvement, leading to ptosis, limb paralysis, and respiratory failure.

- **Excitatory neurotoxins**

- Can be classified as:
  - Pre-synaptic paralysis ( **$\beta$ -bungarotoxin**) – harder to reverse.
  - Post-synaptic paralysis ( **$\alpha$ -bungarotoxin**) – can be reversed with early antivenom.
- Cause **autonomic storm** (profuse sweating, cardiac failure, pulmonary edema).
- Common in some snake species.



Figure 3. Ptosis with neuromuscular snakebite

- Myotoxicity**

- Can lead to generalized muscle pain, myoglobinuria, and high creatine kinase levels.

- Severe cases may lead to renal failure and hyperkalemia.

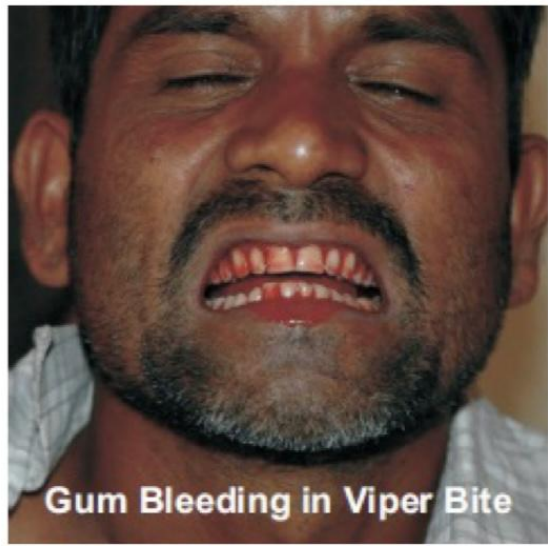
- Coagulopathy and Haemostatic Disorders**

- Some venoms cause severe coagulopathy, bleeding, and bruising.

- Other venoms induce thrombosis (DVT, pulmonary embolism, stroke).

- Renal Damage**

- Russell's viper can cause primary renal failure, while other cases may develop secondary renal damage due to hemolysis.



**Gum Bleeding in Viper Bite**



**Bleeding and Ecchymosis in a Russell's Viper Bite.**

Picture by Dr. Himmatrao S. Bawaskar.



**Envenomed foot**



**Bilateral conjunctival oedema (chemosis) after a bite by a Russell's viper**



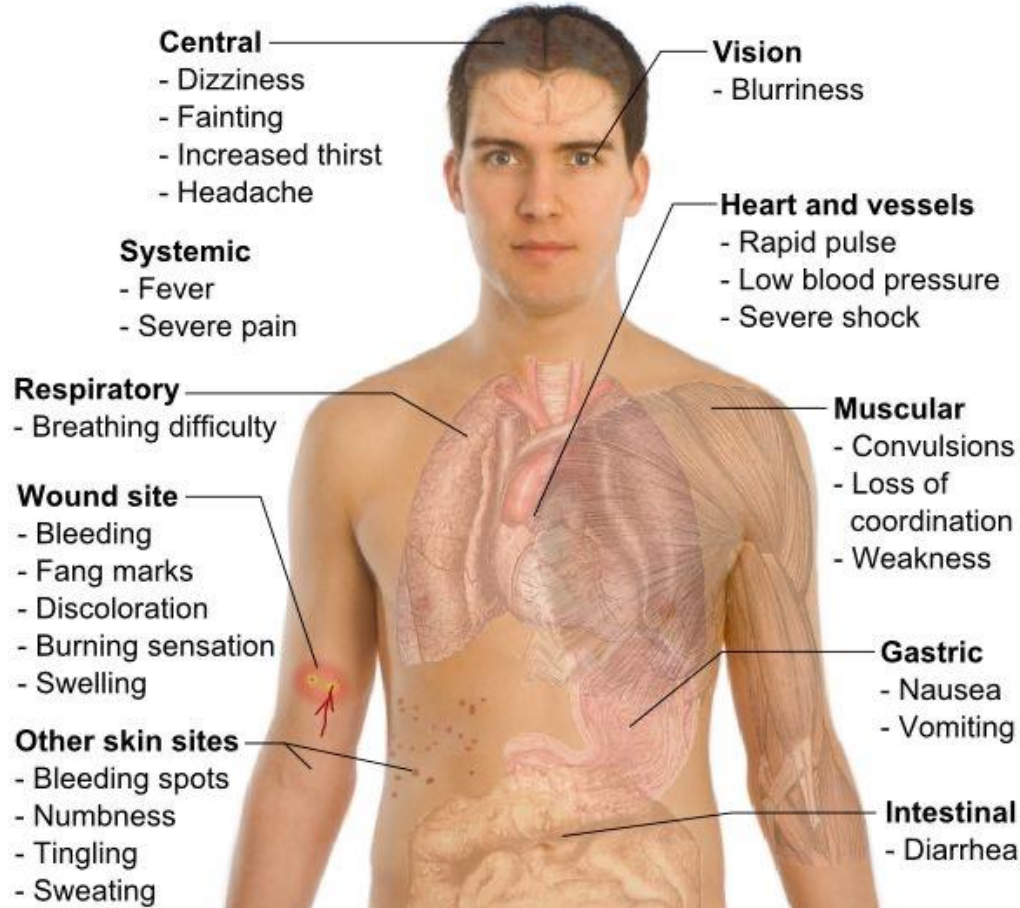
**Poisonous snake bite marks at foot**

Figure 4. Local and systemic Vasculotoxic (haemotoxic or Bleeding) manifestations envenomation.



Figure 11. “Broken neck” sign observed in a 14-year-old girl bitten by a Russell’s viper in India. Envenoming by cobras, kraits and—in some areas—by Russell’s viper frequently leads to progressive descending paralysis. In this case, neuromuscular paralysis persisted for five days despite antivenom treatment, but without progression toward respiratory failure. H. S. Bawaskar. doi:10.1371/journal.pntd.0000603.g002

# General symptoms of Snakebite



| Venom component                  | Clinical effects                                                                                     |
|----------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Neurotoxin</b>                |                                                                                                      |
| Paralytic                        | Flaccid paralysis                                                                                    |
| Excitatory                       | Neuroexcitation: autonomic storm, cardiotoxicity, pulmonary oedema                                   |
| <b>Myotoxins</b>                 | Systemic or local myolysis                                                                           |
| <b>Cardiotoxins</b>              | Direct or indirect cardiotoxicity; cardiac collapse, shock                                           |
| <b>Haemostasis system toxins</b> | Vary from rapid coagulopathy and bleeding to thrombosis, deep venous thrombosis and pulmonary emboli |
| <b>Nephrotoxins</b>              | Renal damage                                                                                         |
| <b>Necrotoxins</b>               | Local tissue injury/necrosis, shock                                                                  |
| <b>Allergic toxins</b>           | Induce acute allergic response (direct and indirect)                                                 |

\*All venom components have lethal potential.



**Local tissue damage**



**Venom gland**



**Neurotoxicity**



**Myotoxicity**



**Coagulopathy**



# DIAGNOSIS OF SNAKE ENVENOMING

- Can be obvious or unclear (e.g., patient unaware of being bitten).
- Consider envenoming in cases of unexplained paralysis, myotoxicity, coagulopathy, nephrotoxicity, or collapse.
- **Lab Tests for Snakebites:**
  - Full blood count
  - Coagulation screen
  - Creatinine and urea levels
  - CK and ECG
- 20-minute whole-blood clotting test is a simple test for coagulopathy.
- Misidentification of snakes can lead to wrong antivenom administration, so identification should be accurate.

| Level of Health-facility                   | Laboratory test                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| District (secondary)-level health facility | Complete blood count<br>Peripheral blood smear<br>Prothrombin time/international normalized ratio<br>Activated partial thromboplastin time (aPTT)<br>Serum creatinine and blood urea nitrogen<br>Serum electrolytes<br>Serum creatinine phosphokinase<br>Liver function tests<br>Random blood glucose<br>Urine routine examination and microscopy<br>ECG<br>Chest x-ray<br>Abdominal ultrasound |
| Tertiary-level health facility             | In addition to the above:<br>D-dimer<br>Plasma fibrinogen<br>Serum lactate dehydrogenase<br>Arterial blood gas analysis<br>Troponin-T/Creatinine phosphokinase MB<br>CT/MRI scan brain<br>2D-Echocardiography                                                                                                                                                                                   |

# Snake bite

Symptoms of a snake bite vary based on what type of snake bit you.

## Symptoms of a **nonvenomous** snake bite:



**Mild swelling.**



**Color changes to your skin.**



**Light bleeding.**

## Symptoms of a **venomous** snake bite:



**Pain.**



**Puncture wound that bleeds.**



**Sweating.**



**Difficulty breathing.**

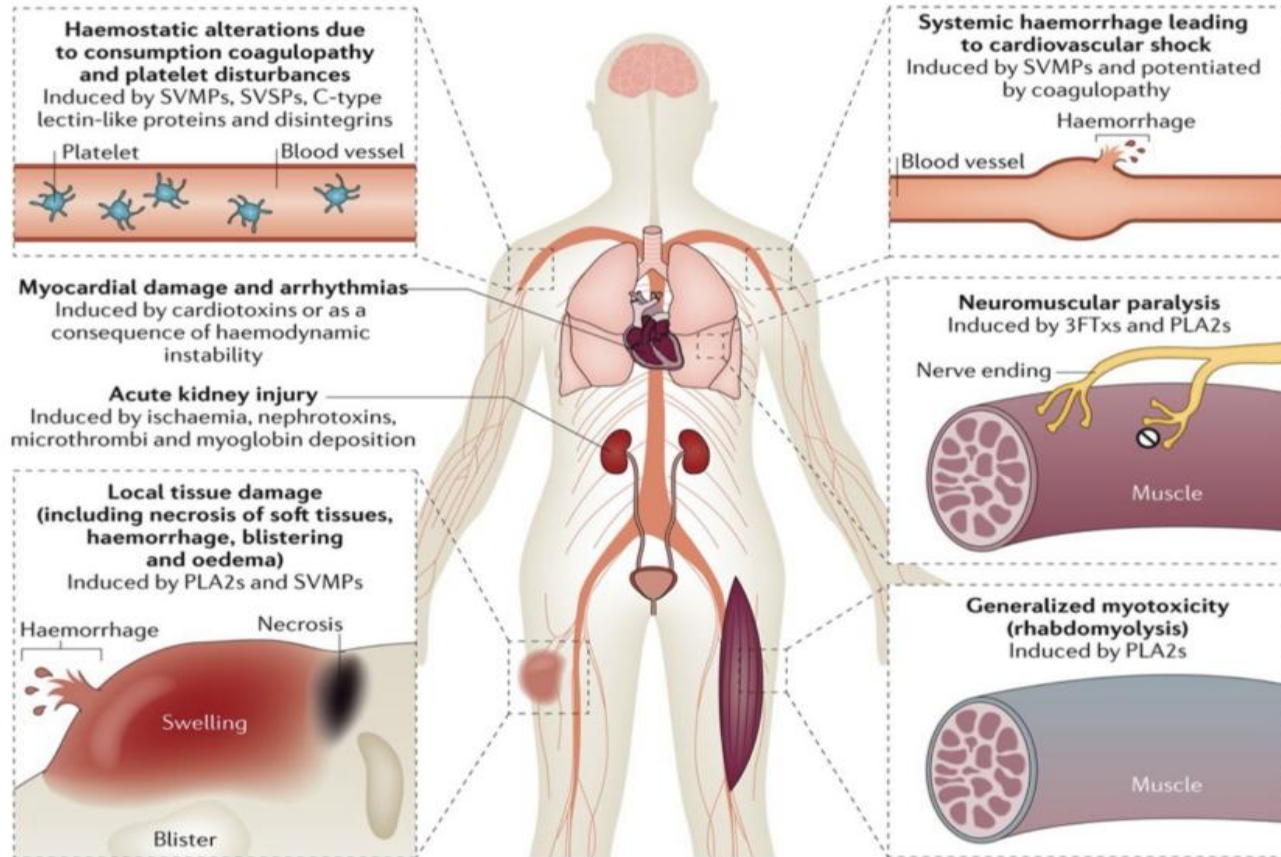


**Headache and dizziness.**



**Nausea and vomiting.**

# Action of snake venom toxins on different body systems



**Intrinsic toxicity**

SVMP : snake venom metalloprotease  
PL : phospholipase, including PLA<sub>2</sub> and PLB  
SVSP : snake venom serine protease  
CLEC : C-type lectin, including CLEC-like  
LAO : L-amino acid oxidase  
3FTx : three-fingered neurotoxins

Nature Reviews | Disease Primers

# MANAGEMENT OF SNAKE BITE ENVENOMATION

- Early and accurate history & examination are essential.

## **First Aid**

- Support vital systems.
- Avoid harmful treatments like cut and suck, electric shock, tourniquets, or cryotherapy.
- Apply pressure immobilization bandage for certain species (Australian snakes, sea snakes, kraits, mambas).
- Cardiorespiratory support for bites leading to paralysis.

# TREATMENT OF VENOMOUS SNAKE BITES

## Field Management

- Perform cardiopulmonary resuscitation (CPR) if needed.
- **Immediate Action:** Transport the victim to definitive medical care as soon as possible.
- **Immobilization:** Splint the affected limb and keep it at heart level to reduce bleeding, pain and slow venom spread .
- **Avoid Harmful Measures: Do not use:**
  - Incisions at the bite site
  - Cooling or ice packs
  - Tourniquets
  - Electric shock
  - Traditional healers & sucking venom.
- **Pressure Immobilization:** If the snake is known to be primarily neurotoxic, apply a pressure bandage (40-70 mmHg for upper limbs, 55-70 mmHg for lower limbs).(For non-necrotic snake bites)
- **No Walking:** The victim should be carried to avoid venom dispersal.



# DO'S & DON'TS DURING SNAKEBITE

## DO'S



**Stay calm and reassure the bitten person.**



**Move slowly away from the snake.**



**Leave the wound area (or bite mark) alone.**



**Remove the shoes, belt, rings, watches, jewellery or tight clothes from the affected area.**



**Make the patient lie in prone, on the left side, with the right leg bent and hand supporting the face.**



**Rush to the nearest health facility for medical treatment.**

## DON'TS



**DON'T allow the victim to become over-exerted or panic.**



**DON'T attack or kill the snake. If you are close enough to hurt it, it can defend itself by biting you.**



**DO not cut and apply or inject any anti-snake venom locally on the wound.**



**Don't tie the affected area to stop blood circulation. It can lead to loss of limbs.**



**DON'T lay the patient on his/her back. Lying on the back can block the airways.**



**Don't use traditional methods or any unsafe treatments.**

## SNAKEBITE PREVENTION AND CONTROL

# HOSPITAL MANAGEMENT

## •Monitoring:

Monitor ECG, blood count, U&Es, CK, and coagulation parameters.

- Vital signs, cardiac rhythm, urine output, and oxygen saturation
- Watch for cranial nerve dysfunction (e.g., ptosis), which may indicate swallowing or respiratory issues.
- Measure limb swelling and circumference every 15 minutes until stabilized
- In remote areas, test blood clotting in a glass container at 20 mins.
- Administer species-specific antivenom promptly.
- Provide cardiovascular, respiratory, and renal support as required.
- Treat coagulation abnormalities accordingly.

## **.Shock Management:**

- Isotonic saline (20-40 mL/kg IV) for initial treatment.
- If hypotension persists, administer 5% albumin (10-20 mL/kg IV) and vasopressors.

# 20 Minute Whole Blood Clotting Test (20WBCT) used for diagnosis.

## Procedure:

- 1-2 mL of venous blood is placed in a clean, dry glass bottle/vial.
- It is left undisturbed at room temperature for 20 minutes.
- The vial is then inverted to check for clot formation.

## Interpretation:

- **Negative test:** Clot forms → No coagulopathy.
- **Positive test:** No clot forms, blood remains liquid → Indicates coagulopathy, requiring antivenom treatment.

## Standardization requirements:

- Use uniform glassware, consistent sample volume, and controlled temperature.
- Validate accuracy with serial donor samples before routine use.

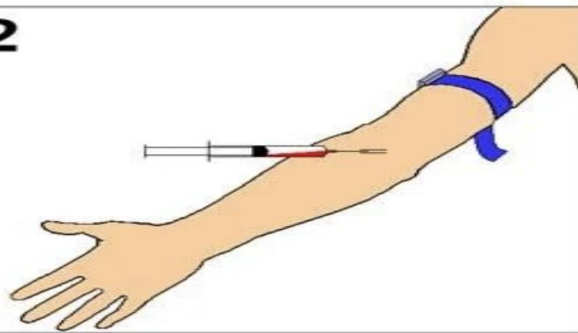
# 20 Minute Whole Blood Clotting Test

For diagnosis of coagulopathy following snakebite envenoming

## 1 What you will need



## 2



## 3

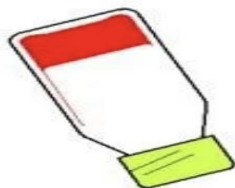


20 minutes

## 4



## 5



20 minutes

NEGATIVE

## 6



20 minutes

POSITIVE

# ANTIVENOM THERAPY

- Most effective treatment for severe envenoming.
- Made from horse antibodies, binds venom toxins & neutralizes them.
- Given intravenously with adrenaline ready (in case of anaphylaxis).
- **Works best for:**
  - Postsynaptic neurotoxin paralysis ( $\alpha$ -bungarotoxin).
  - Coagulopathy (though reversal takes hours).

- **Does NOT reverse:**

- Established pre-synaptic paralysis ( $\beta$ -bungarotoxin).
- Severe tissue necrosis (may only limit further damage if given early).

- **Antivenom reactions:**

- Early (anaphylaxis, not always IgE-mediated).
- Late (serum sickness, delayed hypersensitivity reaction).

- Begin searching for appropriate, specific antivenom early.
- Indications for antivenom administration include:
- Systemic symptoms (e.g., hypotension, coagulopathy)
- Progressive local swelling (crossing a joint or involving >50% of the limb)
- Consult snakebite experts for guidance on antivenom selection and dosing.
- Multiple doses do not reverse established complications like renal failure, paralysis, or necrosis.

10 vials of AVS dissolved  
in 100 ml of distilled  
water and added to  
400ml of normal saline

Mention date and  
time of starting  
infusion



Administer 10 vials of ASV in first hour.  
Maintain slow drip for 24 hours

**Figure 8. ASV infusion and dosage schedule** Each vial of AVS be dissolved in 10 ml of distilled water and added to an infusion medium such as normal saline (i.e. 10 vials of AVS dissolved in 100 ml of distilled water and added to 400ml of normal saline). The volume of infusion is reduced according to the body size and the state of hydration of the patient. In oliguric patients restrict fluids and use infusion pump to give full dose of ASV over 30 minutes.

# ANTIVENOM QUALITY AND REACTIONS

- Global antivenom quality varies, with anaphylactoid reactions occurring in >50% of cases.
- Some authorities recommend pretreatment with:
  - IV antihistamines:
    - Diphenhydramine: 1 mg/kg (max 100 mg)
    - Cimetidine: 5-10 mg/kg (max 300 mg)
    - Prophylactic epinephrine (SC/IM): 0.01 mg/kg (max 0.3 mg)

## **CroFab Antivenom:**

- Used in the United States for treating bites from North American pit vipers (e.g., rattlesnakes, copperheads, cottonmouths).
- Has a low risk of allergic reactions compared to other antivenoms

.

## **Neurologic Dysfunction Management:**

- A trial of acetylcholinesterase inhibitors should be considered for patients showing neurologic dysfunction.
- This may help improve symptoms in bites involving postsynaptic neurotoxins.

## **Extremity Positioning:**

- Once antivenom has been initiated, the affected limb should be positioned above heart level to reduce swelling.

# ADDITIONAL HOSPITAL CARE

- **Tetanus Prophylaxis:** Update tetanus immunization if needed.
- **Muscle Compartment Syndrome:** Monitor for signs of compartment syndrome, which may require surgical intervention (fasciotomy) in severe cases
- **Hospital Observation:**
  - Patients with signs of envenomation should be monitored for at least 24 hours.
  - “Dry bites” (bites without venom injection) require observation for at least 8 hours, as symptoms may appear later.

# SUPPORTIVE TREATMENTS

- Mechanical ventilation for respiratory paralysis.
- IV fluids and renal dialysis for shock and renal failure.
- Prazosin for scorpion sting-induced hypertension/pulmonary edema.
- Antibiotics generally not needed unless wound infection occurs.
- Tetanus prophylaxis should be delayed until coagulopathy resolves.

# FOLLOW-UP

- Monitor pulse, BP, urine output, and oxygen levels.
- Follow-up for late complications and delayed envenoming after discharge.

## 9.21 Important venomous animals in Asia

| Scientific name <sup>1</sup>               | Common name       | Clinical effects                                                                                                     | Antivenom/antidote/treatment |
|--------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------|
| <b>Indian subcontinent</b>                 |                   |                                                                                                                      |                              |
| <i>Bungarus</i> spp. (E)                   | Kraits            | Flaccid paralysis <sup>2,3</sup> , myolysis <sup>4</sup> , hyponatraemia <sup>4</sup>                                | Indian PV or specific        |
| <i>Naja</i> spp. (E)                       | Cobras            | Flaccid paralysis <sup>3</sup> , local necrosis/blistering, shock                                                    | Indian PV or specific        |
| <i>Ophiophagus hannah</i> (E)              | King cobra        | Flaccid paralysis <sup>3</sup> , local necrosis, shock                                                               | Indian PV or specific        |
| <i>Echis</i> spp. (Vv)                     | Saw-scaled vipers | Procoagulant coagulopathy, local necrosis/blistering, renal failure                                                  | Indian PV or specific        |
| <i>Daboia russelli</i> (Vv)                | Russell's viper   | Procoagulant coagulopathy, local necrosis/blistering, myolysis, renal failure, shock, flaccid paralysis <sup>2</sup> | Indian PV or specific        |
| <i>Hypnale</i> spp. (Vc)                   | Hump-nosed vipers | Procoagulant coagulopathy, shock, renal failure                                                                      | Try Indian PV                |
| <i>Trimeresurus</i> <sup>4</sup> spp. (Vc) | Green pit vipers  | Procoagulant coagulopathy, local necrosis, shock                                                                     | Indian PV or specific        |

**Table No. 1-Signs & symptoms of Snake bite:-**

| <b>Features</b>                              | <b>Cobras</b>   | <b>Kraits</b>      | <b>Russel's<br/>viper</b> |
|----------------------------------------------|-----------------|--------------------|---------------------------|
| Local progressive<br>pain / tissue<br>damage | Yes             | No                 | Yes                       |
| Neurological sign                            | Yes (early<br>) | Yes (late<br>)     | Rare                      |
| Hemostatic<br>abnormality                    | No              | In black<br>kraits | Yes                       |
| Renal<br>complication                        | No              | No                 | Yes                       |
| Response to<br>neostigmine                   | Yes             | +/-                | No                        |
| Response to ASV                              | Yes             | Yes                | Yes                       |

# NATIONAL ACTION PLAN FOR PREVENTION AND CONTROL OF SNAKEBITE ENVENOMING (NAPSE)

"A strategic approach to halve the deaths and disabilities  
due to snakebite envenoming by 2030"



Developed by  
**Centre for One Health**  
National Centre for Disease Control, Directorate General of Health Services  
**Ministry of Health and Family Welfare, Government of India**



Figure 11- Road map of WHO Global Strategy for Snakebite Envenoming Prevention and Control

## Medically Important Snakes

|                                                                          |                                                               |                                                                  |
|--------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------|
| Russell's viper ( <i>Daboia russelii</i> )                               | Spectacled cobra ( <i>Naja naja</i> )                         | Sind krait ( <i>Bungarus sindanus</i> )                          |
| Hump-nosed pit viper ( <i>Hypnale hypnale</i> )                          | Common krait ( <i>Bungarus caeruleus</i> )                    | Salazar pit viper ( <i>Trimeresurus Salazar</i> )                |
| Mountain pitviper ( <i>ovophis monticola</i> )                           | Hook-nosed sea snake ( <i>Enhydrina schistose</i> )           | Andaman's cobra ( <i>Naja sagittifera</i> )                      |
| Banded krait ( <i>bungarus fasciatus</i> )                               | Himalayan pit viper ( <i>Gloydius himalayanus</i> )           | Annulated sea snake <i>Hydrophis cyanocinctus</i>                |
| Greater black krait ( <i>bungarus niger</i> )                            | Large-scaled pit viper ( <i>Crespadocephalus macrolepis</i> ) | Central Asian cobra ( <i>Naja oxiana</i> )                       |
| Lesser black krait ( <i>bungarus lividus</i> )                           | Malabar pit viper ( <i>Crespadocephalus travancoricus</i> )   | Sochurek's saw-scaled viper ( <i>Echis carinatus sochureki</i> ) |
| Red-necked keelback ( <i>Rhabdophis subminiatus</i> )                    | Saw-scaled viper ( <i>Echis carinatus</i> )                   | King cobra ( <i>Ophiophagus Hannah</i> )                         |
| Northern larged- scaled pit viper ( <i>Craspedocephalus marcolepis</i> ) | Short sea snake ( <i>Hydrophis curtus</i> )                   |                                                                  |

| Case                      | Dose          | Recommendations                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Adult</b>              |               |                                                                                                                                                                                                                                                                                                                                                                                                         |
| Neuroparalytic snake bite | First dose    | 10 vials of ASV as infusion for over 30 to 90 minutes followed by a 2nd dose of 10 vials after 1 hour (only if no improvement seen within the 1st hour).                                                                                                                                                                                                                                                |
|                           | Repeated dose | Repeat ASV when there is worsening neurotoxic or cardiovascular signs even after 1–2 hr. Maximum dose of 20 ASV vials can be given for neurotoxically envenomed patients. If large doses have been administered and the coagulation abnormality persists, give fresh frozen plasma (FFP) or cryoprecipitate (fibrinogen, factor VIII), fresh whole blood, if FFP not available or platelet concentrate. |

| Case                    | Dose          | Recommendations                                                                                                                                                                                                                                                                                                                            |
|-------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vasculotoxic snake bite | First dose    | 10 vials of polyvalent ASV stat over 30 to 90 minutes as infusion, followed by 6 vials 6 hourly as bolus therapy till clotting time normalizes and/or local swelling subsides.                                                                                                                                                             |
|                         | Repeated dose | Repeat clotting test every 6 hours until coagulation is restored. Administer ASV every 6 h until coagulation is restored.<br>If 30 vials of ASV have been administered reconsider whether continued administration of ASV is serving any purpose, particularly in the absence of proven systemic bleeding.                                 |
| Pregnancy               |               | Pregnant women are treated in exactly the same way as other victims. The same dosage of ASV should be given. However, the change in the physiology in pregnancy should be monitored. Refer the victim to a gynaecologist for assessment of any impact on the foetus.                                                                       |
| Children                |               | Children are also given exactly the same dose of ASV as adults, as snakes inject the same amount of venom into children and adults.<br><i>Infusion:</i> liquid or reconstituted ASV is diluted in 5-10 ml/kg body weight of normal saline.<br>However, reduce the amount of fluid in the running bottle to 200 ml to avoid fluid overload. |

# SNAKEBITE

Let's put an end to snakebite deaths



# REFERENCES

1) DAVIDSON'S ESSENTIALS  
OF MEDICINE 2ND EDITION

2) HARRISON'S MANUAL OF  
MEDICINE 19th EDITION

3) [www.who.int](http://www.who.int)

4) [ncdc.mohfw.gov.in](http://ncdc.mohfw.gov.in)

— — —

**THANK YOU**