

STANDARD TREATMENT GUIDELINES

Management of Snake Bite

Quick Reference Guide
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सत्यमेव जयते

Ministry of Health & Family Welfare
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1. Introduction

Snakebite is an acute life threatening time limiting medical emergency. It is a preventable public health hazard often faced by rural population in tropical and subtropical countries with heavy rainfall and humid climate.

There are more than 2000 species of snakes in the world and about 300 species are found in India out of which 52 are venomous. The venomous snakes found in India belong to three families Elapidae, Viperidae and hydrophidae (Sea Snakes). The most common Indian elapids are *Naja naja* (Indian Cobra) and *Bungarus caeruleus* (Indian Krait), *Daboia russalae* (Russells' Viper) and *Echis carinatus* (Saw scaled viper) (Alirol et al 2010). Clinical effects of envenoming by same species of snake are almost similar except a few regional variations. Kraits are active during night hours, often biting a person sleeping on floor bed. Maximum Viper and Cobra bites occur during the day or early darkness, while watering the plantation or walking bare foot in grown grass or soybean crops.

Although total number of bites may be more than 5-6 lakhs but only 30% are venomous bites. According to Mahapatra et al (on the basis of Million Death Study), non-fatal bites may be as high as 1.4 million per year. Though snakebite is a life threatening centuries old condition, it was included in the list of neglected tropical diseases by World Health Organization in the year 2009 (Warrell and WHO 2009; Bawaskar HS 2014).

Currently, treatment quality is highly varied, ranging from good quality in some areas, to very poor quality treatment in others. The high fatality due to Krait bite is attributed to the non-availability of antsnake venom (ASV), delayed and inappropriate administration of ASV, lack of standard protocol for management and inexperienced doctors and non-availability of ventilator or bag and valve (Bawaskar et al 2008). In India, there has always been a crisis of antivenom supply (Bawaskar HS and Bawaskar PH 2001). On one hand there is shortage of ASV but on the other hand scarce ASV is being wasted due to excessive dosage of ASV in the absence of a Standard Treatment Guideline. Victims are not only misdiagnosed as - abdominal colic, and vomiting due to indigestion, appendicitis, stroke, head injury, ischemic heart disease, food poisoning, trismus, hysteria and Guillain-Barre' syndrome but also subjected to unnecessary investigations including MRI scans of the brain and lumbar puncture thus causing undue delay in ASV therapy. Delayed administration

of ASV or waiting until victim develops systemic manifestations i.e., a 6 h wait results in systemic envenoming and high fatality (Bawaskar et al 2008).

1. Incidence of Snake Bite in India

There is a huge gap between the number of snakebite deaths reported from direct survey and official data. Only 7.23% snakebite deaths were officially reported (Majumdar, 2014 and Mohapatra 2011). Earlier hospital based reports estimated about 1,300 to 50,000 annual deaths from snakebites per year in India. Mohapatra et al, 2011, reported direct estimates from a national mortality survey of 1.1 million homes in 2001–03. The study found 562 deaths (0.47% of total deaths) were assigned to snakebites, mostly in rural areas, and more commonly among males than females and peaking at ages 15–29. This proportion represents about 45,900 annual snakebite deaths nationally or an annual age-standardized rate of 4.1/100,000, with higher rates in rural areas (5.4) and with the highest rate in the state of Andhra Pradesh (6.2). Annual snakebite deaths were greatest in the states of Uttar Pradesh (8,700), Andhra Pradesh (5,200), and Bihar (4,500). Other Indian states with high incidence of snakebites cases are Tamil Nadu, West Bengal, Maharashtra and Kerala. Because a large proportion of global totals of snakebites arise from India, global snakebite totals might also be underestimated. (Mohapatra et al 2011).

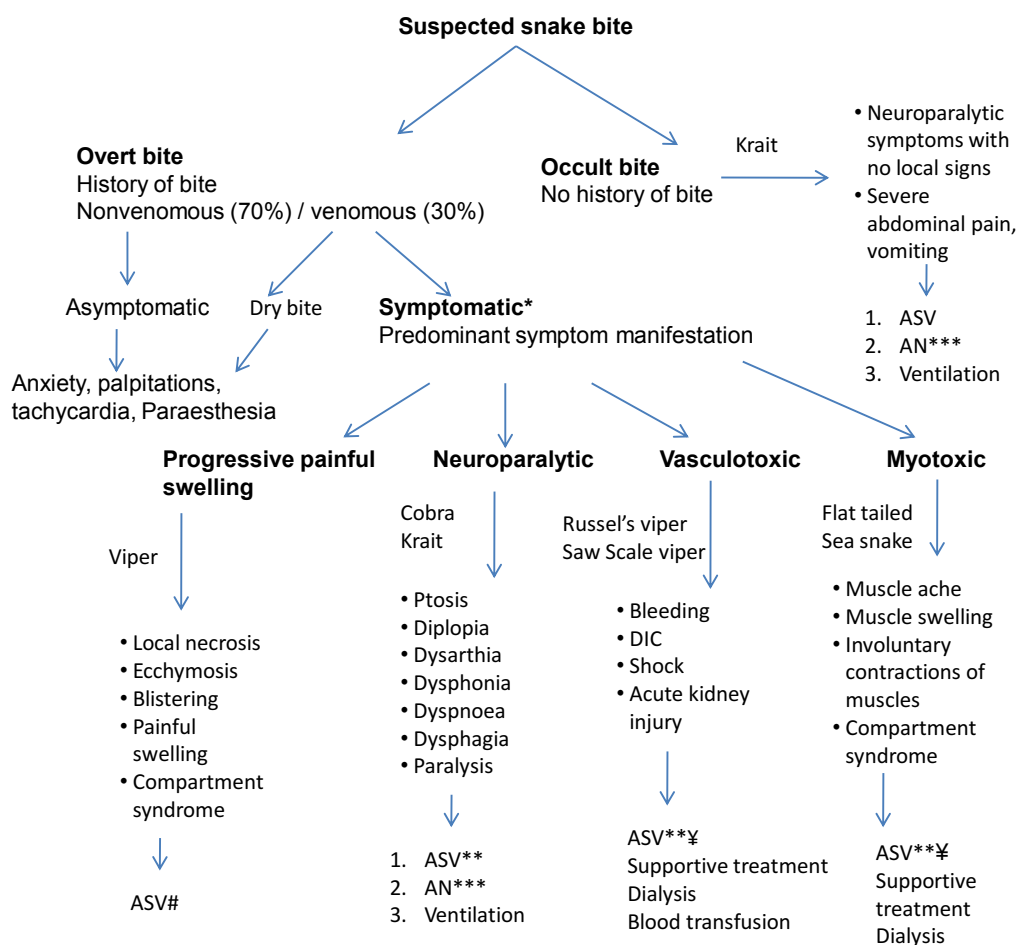
Only 22.19% of the snakebite victims attended the hospitals. Nearly 65.7% of the snakebite deaths were due to common krait bite, most of them occurring in the months of June to September (Majumder et al, 2014). This is because even today most of the victims initially approach traditional healers for treatment and many are not even registered in the hospital. Singh et al reported among the snakebite victims, about 60.76% received first aid at the site of incident, and 20.25% of them sought hospital care after consulting the traditional healers (ozhas, or mantrik and tandrik). Time lapsed for seeking hospital treatment was less than 4 h in 55.69% of the cases and more than 12 h in 7.59% of the cases. Most (41.79%) patients were frightened, but no local or systemic symptoms had appeared when they reported the emergency (Singh A et al 2015).

2. WHEN TO SUSPECT/RECOGNIZE

CLINICAL PRESENTATION:

Clinical presentation of snakebite victim depends upon species of snake, amount of venom injected, season of the bite, whether snake is fed or unfed, site of bite, area covered or uncovered, dry or incomplete bite, multiple bites, venom injection in vessel, weight of the victim and time elapsed between the bite and administration of ASV. Venom concentration and constitution depends on environmental conditions as well as snake's maturity and darkness of colour of snake (Bawaskar HS et al 2014).

Patient can present in the four clinical syndromes or in combination i.e. progressive weakness (neuroparalytic/neurotoxic), bleeding (vasculotoxic/haemotoxic), myotoxic and painful progressive Swelling (Figure 1).



- * Even though present as predominant manifestation but there may be overlap of syndrome as well.
- # ASV indicated in rapidly developing swelling only. Purely localized swelling with or without bite marks is not an indication of ASV.
- ** For reaction to antivenom (ASV) Dose of Adrenaline 0.5 mg IM (in children 0.01 mg/kg)
- ¥ Specific ASV for sea snake and Pit viper bite is not available in India. However, available ASV may have some advantage by cross reaction.
- *** Atropine 0.6 mg followed by neostigmine (1.5mg) to be given IV stat (In children Inj. Atropine 0.05 mg/kg followed by Inj. Neostigmine 0.04 mg/kg IV.) Repeat neostigmine dose 0.5 mg (in children 0.01mg/kg) with atropine every 30 minutes for 5 doses. Thereafter taper dose at 1 hour, 2 hour, 6 hours and 12 hour. Positive response is measured as 50% or more recovery of the ptosis in one hour. If no response after 3rd dose. Stop AN injection.

Figure 1. Four presenting clinical syndromes of snakebite i.e. progressive weakness (neuroparalytic/neurotoxic), bleeding (vasculotoxic/haemotoxic), myotoxic and painful progressive Swelling and its management.

3. Recommendations

4.1 FIRST AID MEASURES

4.1.1 - by bystander or victim- Immediately transfer after providing first aid to a health facility where optimal medical care with antsnake venom (ASV) is available, close observation can be maintained, facility for laboratory investigation is available, and definite treatment can be provided.

4.1.2 At The Community or Village Level

- Check history of snakebite and look for obvious evidence of a bite (fang puncture marks, bleeding, swelling of the bitten part etc.). However, in krait bite no local marks may be seen. It can be noted by magnifying lens as a pin head bleeding spot with surrounding rash.
- Reassure the patient as around 70% of all snakebites are from non-venomous species.
- Immobilize the limb in the same way as a fractured limb. Use bandages or cloth to hold the splints (wooden stick), **but do NOT block the blood supply or apply pressure**. Ideally the patient should lie in the recovery position (prone, on the left side) with his/her airway protected to minimize the risk of aspiration of vomitus.



- Nil by mouth till victim reaches a medical health facility.
- Traditional remedies have NO PROVEN benefit in treating snakebite.
- Shift the victim to the nearest health facility (PHC or hospital) immediately.
- Arrange transport of the patient to medical care as quickly, safely and passively as possible by vehicle ambulance (toll free no. 102/108/etc.), boat, bicycle, motorbike, stretcher etc.



- Victim must not run or drive himself to reach a Health facility. Motorbike Ambulance may be a feasible alternative for rural India.
- If possible PHC medical officer can accompany with patient to know the progress and management and facilitate resuscitation on the way.
- Inform the doctor of any symptoms such as progress of swelling, ptosis or new symptoms that manifest on the way to hospital.
- Remove shoes, rings, watches, jewellery and tight clothing from the bitten area as they can act as a tourniquet when swelling occurs.
- Leave the blisters undisturbed.

Important don'ts

- Do not attempt to kill or catch the snake as this may be dangerous.
- Discard traditional first aid methods (black stones, scarification) and alternative medical/herbal therapy as they have no role and do more harm than good by delaying treatment.
- Do not wash wound and interfere with the bite wound (incisions, suction, rubbing, tattooing, vigorous cleaning, massage, application of herbs or chemicals, cryotherapy, cautery) as this may introduce infection, increase absorption of the venom and increase local bleeding.
- Do NOT apply or inject antivenom (ASV) locally.
- Do not tie tourniquets as it may cause gangrenous limbs.
- If victim is expected to reach the hospital in more than 30 minutes but less than 3 hours crepe bandage may be applied by qualified medical personnel till the patient is shifted to the hospital. The bandage is wrapped over the bitten area as well as the entire limb with the limb placed in a splint. It should be capable of admitting a finger beneath it (See Figure 2.)



Figure 2: Pressure immobilization (Sutherland method)

4.1.3 At A Health Care Facility

- **Admit all victims of snakebite confirmed or suspected and keep under observation for 24 hours.**
- Provide first-aid measures, supportive measures immediately. Observe for signs of envenomation. Administer ASV therapy as soon as there is evidence of envenomation.

4.2 Sign & Symptoms

Examine the bite site and look for fang marks, or any signs of local envenomation.

Fang mark or their patterns have no role to determine whether the biting species was venomous or non venomous or amount of venom injected, severity of systemic poisoning and nature of poisoning – Elapidae or viperidae venom etc.

Some species like Krait may leave no bite marks.

See figure 1 for presenting clinical syndromes of venomous snakebite.

4.2.1 Asymptomatic (i.e., non Venom related symptoms)

Patients many a times present with nonspecific symptoms related to anxiety. Common symptoms in these patients are:

- Palpitations, sweating, tremoulessness, tachycardia, tachypnoea, elevated blood pressure, cold extremities and paraesthesia. These patients may have dilated pupils suggestive of sympathetic over activity.
- Differentiate from symptoms and signs of envenomation listed below.
- Redness, increased temperature, persistent bleeding and tenderness locally. However, local swelling can be present in these patients due to tight ligature

4.2.2 Dry Bite

- Bites by nonvenomous snakes are common and bites by venomous species are not always accompanied by the injection of venom (dry bites).
- The percentage of dry bites ranges from 10–80% for various poisonous snakes.
- Some people who are bitten by snakes (or suspect or imagine that they have been bitten) or have doubts regarding bite may develop quite striking symptoms and signs, even when no venom has been injected due to understandable fear of the consequences of a real venomous bite.
- Even in case of dry bite, symptoms due to anxiety and sympathetic over-activity (as above) may be present. As symptoms associated with panic or stress sometimes mimic early envenoming symptoms, clinicians may have difficulties in determining whether envenoming occurred or not.

4.2.3- Neuroparalytic (Progressive weakness; Elapid envenomation)

- Neuroparalytic snakebite patients present with typical symptoms within 30 min– 6 hours in case of Cobra bite and 6 – 24 hours for Krait bite; however, ptosis in Krait bite have been recorded as late as 36 hours after hospitalization.
- These symptoms can be remembered as 5 Ds and 2 Ps.
 - 5 Ds – dyspnea, dysphonia, dysarthria, diplopia, dysphagia
 - 2 Ps – ptosis, paralysis

- In chronological order of appearance of symptoms – furrowing of forehead, **Ptosis** (drooping of eyelids) occurs first (Figure 3), followed by **Diplopia** (double vision), then **Dysarthria** (speech difficulty), then **Dysphonia** (pitch of voice becomes less) followed by **Dyspnoea** (breathlessness) and **Dysphagia** (Inability to swallow) occurs. All these symptoms are related to 3rd, 4th, 6th and lower cranial nerve paralysis. Finally, paralysis of intercostal and skeletal muscles occurs in descending manner.
- Other signs of impending respiratory failure are diminished or absent deep tendon reflexes and head lag.
- Additional features like stridor, ataxia may also be seen.
- Associated hypertension and tachycardia may be present due to hypoxia.



Figure 3. Ptosis with neuroparalytic snakebite

- To identify impending respiratory failure bedside lung function test in adults viz.
 - Single breath count – number of digits counted in one exhalation - >30 normal
 - Breath holding time – breath held in inspiration – normal > 45 sec
 - Ability to complete one sentence in one breath.
- Cry in a child whether loud or husky can help in identifying impending respiratory failure.
- ***Bilateral dilated, poorly or a non-reacting pupil is not the sign of brain dead in elapid envenoming (Figure 3).***
- **Refer patients presenting with neuroparalytic symptoms immediately to a higher facility for intensive monitoring after giving Atropine Neostigmine (AN) injection (schedule of AN injection described below).**

4.2.4 Vasculotoxic (haemotoxic or Bleeding) - General signs and symptoms of Viperine envenomation)

Vasculotoxic bites are due to Viper species. They can have local manifestations as well as systemic manifestations.

– **Local manifestations** –

these are more prominent in Russel's viper bite followed by Saw scaled viper and least in Pit viper bite. Local manifestations are in form of:

- Local swelling, bleeding, blistering, and necrosis.
- Pain at bite site and severe swelling leading to compartment syndrome. Pain on passive movement. Absence of peripheral pulses and hypoesthesia over the fields of nerve passing through the compartment helps to diagnose compartment syndrome.
- Tender enlargement of local draining lymph node.

– **Systemic manifestations** –

- Visible systemic bleeding from the action of haemorrhagins (Figure 4) e.g. gingival bleeding, epistaxis, ecchymotic patches, vomiting, hematemesis, hemoptysis, bleeding per rectum, subconjunctival hemorrhages, continuous bleeding from the bite site, bleeding from pre-existing conditions e.g. haemorrhoids, bleeding from freshly healed wounds.
- Bleeding or ecchymosis at the injection site is a common finding in Viper bites.
- The skin and mucous membranes may show evidence of petechiae, purpura ecchymoses, blebs and gangrene.
- Swelling and local pain.
- Acute abdominal tenderness may suggest gastro-intestinal or retro peritoneal bleeding.
- Lateralizing neurological symptoms such as asymmetrical pupils may be indicative of intra-cranial bleeding.
- Consumption coagulopathy detectable by 20WBCT, develops as early as within 30 minutes from time of bite but may be delayed.



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

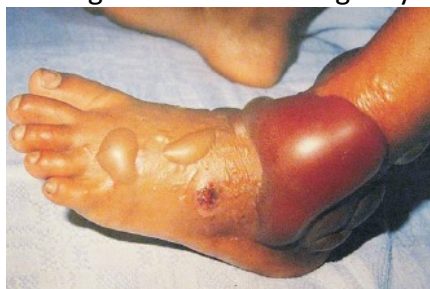
4.2.5 Life threatening complications are due to renal involvement. Patient presents with hematuria, hemoglobinuria, myoglobinuria followed by oliguria and anuria with acute kidney injury (AKI).

- Bilateral renal angle tenderness.
- Passage of discolored (reddish or dark brown urine or declining urine output).
- Acute Kidney Injury e.g. declining or no urine output, deteriorating renal signs such as rising serum creatinine, urea or potassium. Some species e.g. Russell's viper (*Daboia* sp) and Saw scale vipers (*Echis* sp) frequently cause acute Kidney Injury.
- Hypotension due to hypovolaemia or direct vasodilatation or direct cardiotoxicity aggravates acute kidney injury.
- Parotid swelling, conjunctiva oedema, sub-conjunctival haemorrhage, renal failure, acute respiratory distress syndrome [leaking syndrome] and refractory shock.
- Long term sequelae e.g. pituitary insufficiency with Russell's viper (*Daboia* sp), Sheehan's syndrome or amenorrhea in females.

4.2.6 Painful Progressive Swelling (PPS)

Progressive painful swelling is indicative of local venom toxicity. It is prominent in Russel's viper bite, Saw scaled viper bite and Cobra bite. This is associated with

- Local necrosis which often has a rancid smell. Limb is swollen and the skin is taut and shiny. Blistering with reddish black fluid at and around the bite site. Skip lesions around main lesion are also seen. (Figure 5).
- Ecchymoses due to venom action destroying blood vessel wall.
- Significant painful swelling potentially involving the whole limb and extending onto the trunk.
- Compartment syndrome will present invariably.
- Regional tender enlarged lymphadenopathy.



Envenomed foot



Poisonous snake bite marks at foot

Figure 5. Snakebite marks and local swelling and necrosis

4.2.7 Myotoxic

This presentation is common in Sea snakebite. Patient presents with:

- Muscle aches, muscle swelling, involuntary contractions of muscles.
- Passage of dark brown urine.
- Compartment syndrome, cardiac arrhythmias due to hyperkalaemia, acute kidney injury due to myoglobinuria, and subtle neuromuscular signs.

4.2.8- Occult snakebite

- Krait bite victims often present in the early morning with paralysis with no local signs. Krait has nocturnal habitat and has fine slender teeth. Hence bite marks usually cannot be identified even on close examination.
- Typical presenting history is that the patient was healthy at night, in the morning gets up with severe epigastric/umbilical pain with vomiting persisting for 3 – 4 hours and followed by typical neuromuscular symptoms within next 4- 6 hours. There is no history of snakebite.
- Unexplained respiratory distress in children in the presence of ptosis or sudden onset of acute flaccid paralysis in a child (locked-in syndrome) are highly suspicious symptoms in endemic areas particularly of Krait bite envenomation. Sometimes patients may present with throat pain or chest pain also.

Early morning symptoms of acute pain abdomen with or without neuroparalysis can be mistaken for a acute appendicitis, acute abdomen, stroke, GB syndrome, myasthenia gravis and hysteria (Bawaskar 2002). Krait bite envenoming is diagnosed by developing descending neuroparalysis while GB syndrome is by ascending paralysis.

Strong clinical suspicion and careful examination can avoid not only costly and unnecessary investigations such as CT scan, MRI, nerve conduction studies, CSF studies and many others but also help in avoiding undue delay in initiation of a specific treatment with ASV. Atropine neostigmine (AN) test helps to rule out myasthenia gravis.

4.2.9 Differential identification of type of snakebite based on the symptoms and signs

Though to a large extent the manifestation of snakebite depends upon the species of snake, unfortunately, in many cases the biting snake is not seen, and if it is, its description by the victim is often misleading (Harris et al 2010). Therefore identification of the type of snake should not hold the treatment. At times the bite mark might not be visible (e.g., in the case of Krait). The clinical manifestations of the patient may not correlate with the species of snake brought as evidence. However, it is advantageous to know the appearance of the snake so as to recognize the species (Figure 6). The killed snake brought as evidence helps in identification of snake, in which case species-specific monovalent Antisnake venom (ASV) can be administered. However, monovalent ASV is not available in India.

Inspection of local site of bite can also help to identify snake's species. Local swelling, bleeding, blistering, necrosis suggests Cobra bite. Minimum local changes indicate Krait bite. Local bleeding suggests Nilgiri Russel's viper. Pain in abdomen and hyper peristalsis indicates Krait bite.



Figure 6. Snake identification by the patient

ON PRESENTATION, PATIENTS CAN BE CRITICAL OR NON CRITICAL (See FIGURE 1).

4.3. ASSESSMENT

4.3.1 Critical Arrival: *Patient assessment on arrival*

- Vasculotoxic patients presenting with bleeding from multiple orifices with hypotension, reduced urine output, obtunded mentation (drowsy, confused), cold extremities need urgent attention and ICU care for volume replacement, pressor support, dialysis and infusion of blood and blood products (See following sections).
- Neuroparalytic patients presenting with respiratory paralysis, tachypnoea or bradypnoea or paradoxical respiration (only moving abdomen), obtunded mentation, and peripheral skeletal muscle paralysis need urgent ventilator management with endotracheal intubation, ventilation bag or ventilator assistance.
- Other patients can be evaluated to decide severity of their illness.

4.3.2 *Patient assessment: Non critical arrival and Critical patients after stabilization*

- Determine the time elapsed since the snakebite and as to what the victim was doing at the time of the bite, history of sleeping on floor bed in previous night.
- Determine if any traditional medicines have been used.
- Obtain a brief medical history (e.g., date of last tetanus immunization, use of any medication, presence of any systemic disease, and history of allergy)
- If the victim has brought the snake, identification of the species should be carried out carefully, since crotalids can envenomate even when dead. This is why bringing the killed snake into the emergency department should be discouraged.

4.3.3 Physical examination

- Careful assessment of the site of the bite and signs of local envenomation and examination of the patient should be carried out and recorded (Annexure 1). Monitor the patient closely and repeat all above, every 1-2 hourly.
- Check for and monitor the following: Pulse rate, respiratory rate, blood pressure and 20 minutes Whole Blood clotting test (20 WBCT) every hour for first 3 hours and every 4 hours for remaining 24 hours.

- Check distal pulses and monitor if there is presence of gross swelling. The presence of a pulse does not rule out compartment syndrome. **Pain on passive movement, pallor, pulseless limb, hypoaesthesia over the sensory nerve passing through the compartment are suggestive of compartment syndrome.** Measure compartment pressure directly if there is concern that a compartment syndrome is developing. The diagnosis is established if the compartment pressure, measured directly by inserting a 16 G IV cannula and connecting it with manometer, is raised above 40 cm water/saline. Direct measurement is necessary before resorting to fasciotomy since compartment syndrome is rare in snakebite victims and fasciotomy done without correction of hemostatic abnormality may cause the patient to bleed to death

4.3.4 Examination of pregnant women

Monitor uterine contractions and foetal heart rate. Lactating women who have been bitten by snakes should be encouraged to continue breast feeding .

Clues for severe snake envenomation should be sought are:

- Rapid early extension of local swelling from the site of the bite. In Cobra bite on finger, necrosis may start in few minutes.
- Early tender enlargement of local lymph nodes, indicating spread of venom in the lymphatic system
- Visible signs of neurological impairment such as ptosis, muscular weakness, respiratory distress or respiratory arrest.
- Early spontaneous systemic bleeding especially bleeding from the gums, bite site, haematuria, haemoptysis, epistaxis or ecchymoses.
- Unconsciousness either with or without respiratory arrest.
- Passage of dark brown urine
- Snake identified as a very venomous one i.e., Cobra, Russel's viper.

4.4 LAB INVESTIGATIONS

4.4.1 20 minute whole blood clotting test (20 WBCT):

- It is a bedside test.
- Place 2 ml of freshly sampled venous blood in a small glass test tube and leave undisturbed for 20 minutes at ambient temperature.
- Gently tilt the test tube to see if the blood is still liquid; the patient has hypofibrinogenaemia (“incoagulable” blood or “**not clotted**”) as a result of

venom-induced consumption coagulopathy (Figure 7).

- If blood clot is formed and signs and symptoms of neurotoxic envenomation present, classify as neurotoxic envenomation.
- If there is any doubt, repeat the test in duplicate, including a “control” (blood from a healthy person).
- **Caution:** If the test tube used for the test is not made of ordinary glass, or if it has been used before and cleaned with detergent, its wall may not stimulate clotting of the blood sample in the usual way and test will be invalid).
- *Counsel patient and relatives in the beginning that, 20WBCT may be repeated several times before giving any medication.*

20WBCT

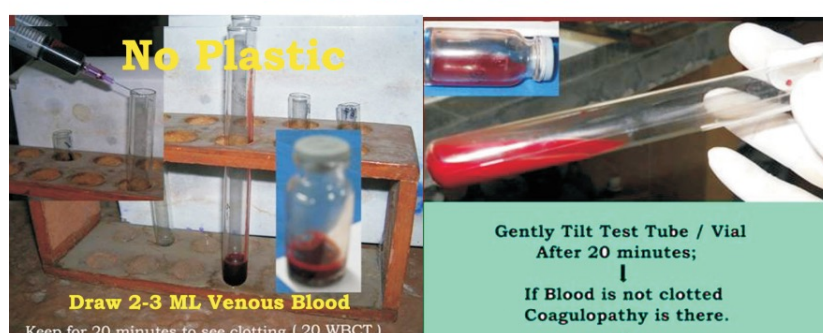


Figure 7. 20 minute whole blood clotting test (20 WBCT).

- If clotted, the test should be carried out every 1 h from admission for three hours and then 6 hourly for 24 hours. In case test is non-clotting, repeat 6 hour after administration of loading dose of ASV. **In case of neurotoxic envenomation repeat clotting test after 6 hours.**

Other investigations that may assist in the management of snake bite at various levels of healthcare

4.4.2 – Other Lab tests at Primary health centre

- Peak flow meter in patients (adolescents and adults) presenting with neuroparalytic syndrome.
- If Peak flow meter is not available in PHC then assess respiratory function using bedside tests - single breath count, breath holding time and ability to complete one sentence in one health as described earlier.
- Urine examination for albumin and blood by dipstick.

4.4.3 Others lab test at District Hospital

In addition to the above

- Prothrombin time
- Platelet count,
- Clot retraction time
- Liver function test (LFT)
- Renal Function test (RFT)
- Serum Amylase
- Blood sugar
- ECG
- Abdominal ultrasound
- 2D Echo (if available)

4.4.4 Others Lab test at Tertiary Health Care Centre

In addition to the above

- *In neuromuscular envenomation*
 - Arterial blood gases. Caution: Arterial puncture is contraindicated in patients with haemostatic abnormalities.
 - Pulmonary function tests
- *In Vasculotoxic venomation*
 - For coagulopathy- BT, CT, PT, APTT, Platelet, Serum Fibrinogen, FDP D-Dimer assay, LDH, peripheral blood smear
 - Hemolysis -Urine for myoglobin, Urine haemoglobin
 - For renal failure- Urine microscopy for RBC, casts, RFT, urinary proteins, creatinine ratio
 - Hepatic injury – LFTs including SGOT, SGPT, Alkalien phosphatase, serum proteins
 - Cardiotoxicity- CPK-MB, 2D Echo, BNP
 - Myotoxic – CPK, SGOT, Urine myoglobin, compartment pressure
 - Infection- Serum procalcitonin, culture (blood, urine, wound) and sensitivity
- Arterial blood gases and urine examination should be repeated at frequent intervals during the acute phase to assess progressive systemic toxicity).

4.4.5- Rationale and interpretation of the tests:

4. Hemogram: The hemogram may show transient elevation of hemoglobin level due to hemoconcentration (because of the increased capillary leak) or may show anemia (due to hemolysis, especially in

viper bites). Presence of neutrophilic leucocytosis signifies systemic absorption of venom. Thrombocytopenia may be a feature of viper envenomation.

5. *Platelet count*: This may be decreased in victims of envenoming by vipers.
White blood cell count: An early neutrophil leucocytosis is evidence of systemic envenoming from any species.
Blood film: Fragmented red cells ("helmet cell", schistocytes) are seen when there is microangiopathic haemolysis.
Plasma/serum: May be pinkish or brownish if there is gross haemoglobinaemia or myoglobinaemia.
6. Serum creatinine: This is necessary to rule out acute kidney injury after viper and sea snakebite.
7. Serum creatinine phosphokinase (CPK): Elevated levels of these markers suggests muscle damage (caution for renal damage) and raised amylase suggests pancreatic injury
8. Prothrombin time (PT) and activated partial thromboplastin time (aPTT): Prolongation may be present in viper bite (to be repeated 6 hourly, if abnormal).
9. Fibrinogen and fibrin degradation products (FDPs): Low fibrinogen with elevated FDP is present when venom interferes with the clotting mechanism.
10. Urine examination for Proteinuria/ RBC/ Haemoglobinuria/ Myoglobinuria: The colour of the urine (pink, red, brown, black) should be noted and the urine should be tested by dipsticks for blood or haemoglobin or myoglobin. Standard dipsticks do not distinguish blood, haemoglobin and myoglobin. Haemoglobin and myoglobin can be separated by immunoassays but there is no easy or reliable test. Microscopy will confirm whether there are erythrocytes in the urine.
11. Electrocardiogram (ECG): Nonspecific ECG changes such as bradycardia and atrioventricular block with ST-T changes may be seen.
12. Electroencephalogram (EEG): Recently, EEG changes have been noted in up to 96% of patients bitten by snakes. These changes start within hours of the bite but are not associated with any features of encephalopathy. Sixty-two percent showed grade I changes, 31% cases manifested grade II changes (moderate to severe abnormality), and the remaining 4% showed severe abnormality (grade III). These abnormal EEG patterns were seen mainly in the temporal lobes (Ramachandran S et al 1995). However, rarely needed for patient management.
13. Pulse oximetry for oxygen in patients with respiratory failure or shock.
14. Electrolyte determinations: These tests are necessary for patients with respiratory paralysis and systemic symptoms.
15. Arterial blood gases and pH may show evidence of respiratory failure (neurotoxic

envenoming) and acidaemia (respiratory or metabolic acidosis).

16. X-Ray/ CT/ Ultrasound (The use of X-Ray and ultrasound are of unproven benefit, apart from identification of bleeding in Viperine bites).

4.5 ANTI SNAKE VENOM (ASV) THERAPY

- **If ASV is indicated i.e. signs and symptoms of envenomation with or without evidence of laboratory tests, administer full dose.**
- **There are no absolute contraindications to ASV.**
- Do not routinely administer ASV to any patient claiming to have bitten by a snake as ASV exposes such patients to the risks of ASV reactions unnecessarily; besides wastage of valuable and scarce stocks of ASV. **However, at the same time do not delay or withhold ASV on the grounds of anaphylactic reaction to a deserving case. Do NOT give incomplete dose.**
- Purely local swelling, even if accompanied by a bite mark from an apparently venomous snake, is not a ground for administering ASV. Swelling, a number of hours old is also not a ground for giving ASV. **However, rapid development of swelling indicates bite with envenoming requiring ASV.**

4.5.1 Antisnake venom (ASV)

- Antisnake venom treatment is the only specific treatment, should be given as soon as it is indicated. It may reverse systemic envenomation abnormality even when this has persisted for several days or, in the case of haemostatic abnormalities, persisting for two or more weeks. The dosage required varies with the degree of envenomation.
- In the presence of coagulopathy, Polyvalent ASV freeze-dried (heat stable; to be stored at cool temperature; shelf life 5 years) or neat liquid ASV (heat labile; requires reliable cold chain (2-8°C) with a refrigeration shelf life of 2 years) whichever is available may be used. If integrity of the cold chain is not guaranteed then use lyophilized ASV.
- ASV supplied in dry powder form has to be reconstituted by diluting in 10 ml of distilled water/normal saline (Figure 8). Mixing is done by swirling and not by vigorous shaking. **Caution:** Do not use, if reconstituted solution is opaque to any extent.

4.5.2 Precautions during ASV Administration -

- ***ASV should be given only by the IV route, and should be given slowly, with the***

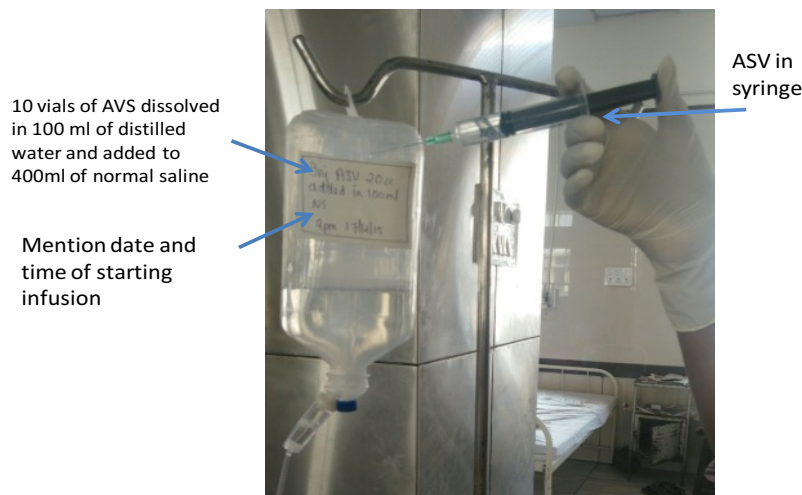
physician at the bed side during the initial period to intervene immediately at the first sign of any reaction. The rate of infusion can be increased gradually in the absence of a reaction until the full starting dose has been administered (over a period of ~1 hour).

- Epinephrine (adrenaline) should always be drawn up in readiness before ASV is administered.
- ASV must **NEVER** be given by the IM route because of poor bioavailability by this route. Also do **NOT** inject the ASV locally at the bite site since it is not effective, is extremely painful and may increase intra-compartmental pressure.
- **Take all aseptic precautions before starting ASV to prevent any pyrogenic reactions to ASV.**

4.5.3- Dose of ASV for neuromuscular snakebite – ASV 10 vials stat as infusion over 30 minutes followed by 2nd dose of 10 vials after 1 hour if no improvement within 1st hour.

4.5.4- Dose of ASV for vasculotoxic snakebite - Two regimens low dose infusion therapy and high dose intermittent bolus therapy can be used. Low dose infusion therapy is as effective as high dose intermittent bolus therapy and also saves scarce ASV doses (Expert Consensus).

- **Low Dose infusion therapy** – 10 vials for Russell’s viper or 6 vials for Saw scaled viper as stat as infusion over 30 minutes followed by 2 vials every 6 hours as infusion in 100 ml of normal saline till clotting time normalizes or for 3 days whichever is earlier.
- OR**
- **High dose intermittent bolus therapy** - 10 vials of polyvalent ASV stat over 30 minutes as infusion, followed by 6 vials 6 hourly as bolus therapy till clotting time normalizes and/or local swelling subsides.
- **No ASV for Sea snakebite or pit viper bite as available ASV does not contain antibodies against them.**
- The range of venom injected is 5 mg-147 mg. The total required dose range between 10 and 30 vials as each vial neutralizes 6 mg of Russell’s Viper venom. Depending on the patient condition, additional vials can be considered.



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.

4.5.5 ASV dose in pregnancy

Pregnant women are treated in exactly the same way as other victims. The same dosage of ASV is given. Refer the victim to a gynecologist for assessment of any impact on the foetus.

4.5.6 ASV dose in children

Children also are given exactly the same dose of ASV as adults as snakes inject the same amount of venom into children and adult.

Infusion: liquid or reconstituted ASV is diluted in 5-10 ml/kg body weight of normal saline. However, reduce amount of fluid in running bottle to 200 ml to avoid fluid over load.

4.5.7 ASV dosage in victims requiring life saving surgery

Rarely patient may develop intracranial bleeding for which a life saving surgery is required. In such cases before surgery coagulation must be restored to avoid catastrophic bleeding and higher initial dose of ASV (up to 30 vials) can be administered.

4.5.8 Repeat dose of ASV

– Repeat dose: in Vasculotoxic or haemotoxic envenomation

Repeat clotting test every 6 hours until coagulation is restored. Administer ASV every 6 h until coagulation is restored. Envenomation by the Hump-nosed Pit viper does not respond to normal Indian polyvalent ASV and coagulopathy may continue for up to 3 weeks. 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.

– Repeat dose: neuromuscular or neurotoxic envenomation

Repeat ASV when there is worsening neurotoxic or cardiovascular signs even after 1–2 h. Maximum dose 20 vials of ASV 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.

4.5.9 Victims who arrive late

Sometimes victims arrive late after the bite, often after several days, usually with acute kidney injury. Determine current venom activity such as bleeding in case of viperine envenomation. Perform 20WBCT and determine if any coagulopathy is present then administer ASV. If no coagulopathy is evident, treat kidney injury, if any.

In patients with neuromuscular envenomation (ptosis, respiratory failure etc.)

- Continue respiratory support until recovery
- Give 10 vials of ASV on arrival and if no improvement within one hour repeat 10 vials of ASV (No more than 20 vials of ASV).
- No further ASV and Atropine Neostigmine (AN) infusion is required ONLY to reverse the Ptosis. Ptosis in Common Krait bite is due to presynaptic blockage, further ASV and Neostigmine dose beyond 3 doses cannot reverse

it, since regeneration is a natural process and may take 4-5 days. Both ASV and AN injection should be stopped when the initial syndrome of pharyngeal muscle palsy is over.

4.5.10 Monitoring of Patients on ASV therapy

- All patients should be watched carefully every 5 min for first 30 min, then at 15 min for 2 hours for manifestation of a reaction. At the earliest sign of an adverse reaction suspend temporarily.
- Maintain a strict intake output chart and note colour of urine to detect acute kidney injury early.

4.6. ASV reaction

- **NO ASV TEST DOSE MUST BE ADMINISTERED.**
- **SKIN/CONJUNCTIVAL HYPERSENSITIVITY TESTING DOES NOT RELIABLY PREDICT EARLY OR LATE ANTISNAKE VENOM REACTIONS AND IS NOT RECOMMENDED.**
- Rarely patients may develop severe life-threatening anaphylaxis characterized by hypotension, bronchospasm, and angioedema. However, 20%-60% patients treated with ASV develop either early or late mild reactions.
- **Early anaphylactic reactions** occurs within 10–180 min of start of therapy and is characterized by itching, urticaria, dry cough, nausea and vomiting, abdominal colic, diarrhoea, tachycardia, and fever.
- **Pyrogenic reactions** usually develop 1–2 h after treatment. Symptoms include chills and rigors, fever, and hypotension. These reactions are caused by contamination of the ASV with pyrogens during the manufacturing process.
- ***Any new sign or symptom after starting the ASV in drip should be suspected as a reaction to ASV.***
- **Late (serum sickness–type) reactions** develop 1–12 (mean 7) days after treatment. Clinical features include fever, nausea, vomiting, diarrhoea, itching, recurrent urticaria, arthralgia, myalgia, lymphadenopathy, immune complex nephritis and, rarely, encephalopathy.

4.6.1 Treatment of Early ASV reaction

- Stop ASV temporarily.

- Oxygen
- Start fresh IV normal saline infusion with a new IV set
- Administer Epinephrine (adrenaline) (1 in 1,000 solution, 0.5 mg (i.e. 0.5 ml) in adults **intramuscular over deltoid or over thigh**; In children 0.01 mg/kg body weight) for early anaphylactic and pyrogenic ASV reactions.
- Administer Chlorpheniramine maleate (adult dose 10 mg, in children 0.2 mg/kg) intravenously.
- **Role of Hydrocortisone in managing ASV reaction is not proved.**
- Once the patient has recovered, re-start ASV slowly for 10-15 minutes keeping the patient under close observation. Then resume normal drip rate.
- **For high risk patients**
In patients with history of hypersensitivity or exposure to animal serum such as equine ASV, tetanus-immune globulin or rabies-immune globulin in past, severe atopic conditions:
 - Give ASV only if they have signs of systemic envenoming.
 - Give Inj. Hydrocortisone 200 mg and Chlorpheniramine maleate 22.75 mg prior to the administration of ASV.
- Epinephrine premedication is not given as routine as it can cause hypertension and in patients with bleeding tendency can lead to intracranial bleeding (Expert Consensus). However, epinephrine should be kept handy for adults. No trials have been done in children and old people. Inj. Adrenaline 0.25 ml of 1:1000 (as available in one ampoule of 1 ml) Subcutaneously just before adding ASV to the running IV fluid.

4.6.2 Treatment of Late (serum sickness–type) reactions

- Inj. Chlorpheniramine 2 mg in adults (In children 0.25 mg/kg/day) 6 hourly for 5 days.
- In patients who fail to respond within 24–48 h give a 5-day course of Prednisolone (5 mg 6 hourly in adults and 0.7 mg/kg/day in divided doses in children).

4.6.3 Desensitization procedure only in case of severe anaphylaxis reaction to ASV

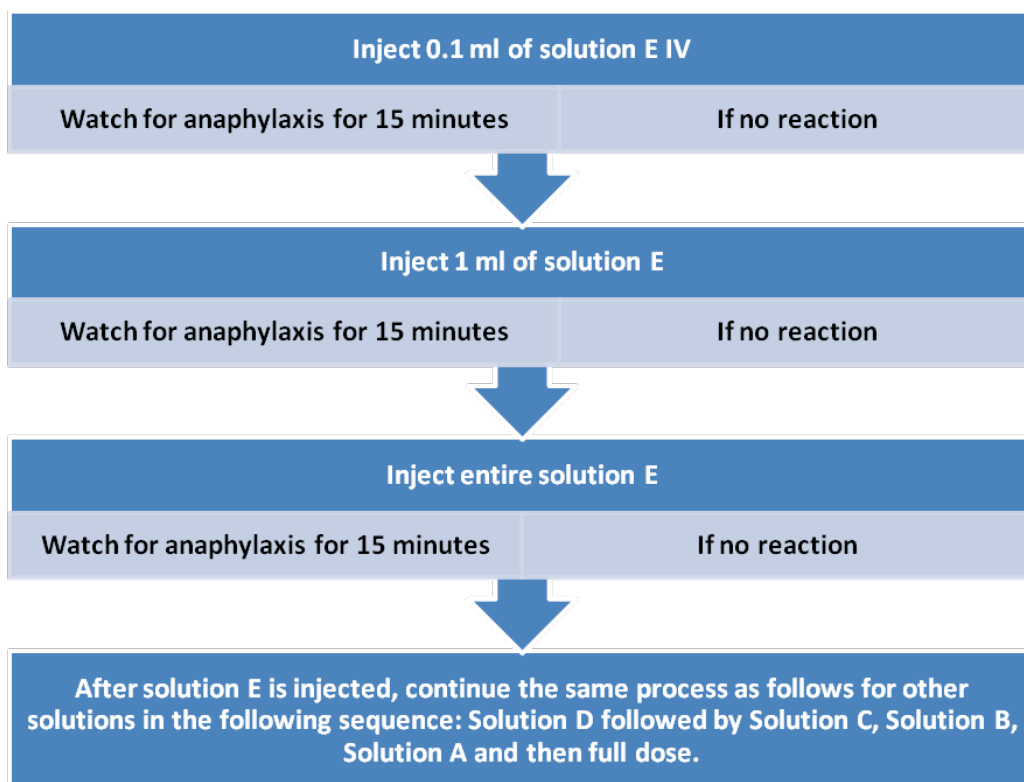
- Pre-medication: Administer Inj. Hydrocortisone 100 mg I.V. and Inj. Adrenaline 0.5 ml subcutaneously/ intramuscularly (+/- Promethazine)

Table . Steps of dilution of ASV

Steps of dilution	Instructions	Total Volume	Solution	Dilution

1.	Dilute 1 ml of ASV in a vial with 10 ml of normal saline	10ml	A	
2.	1ml of solution A + 9 ml of saline	10 ml	B	1: 10
3.	1ml of solution B+ 9 ml of saline	10 ml	C	1: 100
4.	1ml of solution C + 9 ml of saline	10 ml	D	1: 1000
5.	1ml of solution D + 9 ml of saline	10 ml	E	1: 10,000

After dilution and preparation of Solution E,



4.7 MANAGEMENT NEUROTOXIC (NEUROPARALYTIC) ENVENOMATION

Antisnake venom treatment alone cannot be relied upon to save the life of a patient with bulbar and respiratory paralysis. Administer following in addition:

- Oxygen
- Assisted ventilation. The duration of mechanical ventilation in snakebite victims is usually short since neuromuscular paralysis reverses quickly with prompt administration of ASV. Manual ventilation (self ventilating anaesthetic bag) has been effective where no mechanical ventilator was available. In case of Guillain-Barre syndrome and delayed neuropathy following snakebite prolonged assisted ventilation with room air or oxygen is followed by complete recovery.
- Administer 'Atropine Neostigmine (AN)' schedule described as below.
- Refer to a higher facility where ASV is available, in case of no improvement.

4.7.1 Atropine neostigmine (AN) dosage schedule

- Atropine 0.6 mg followed by neostigmine (1.5mg) to be given IV stat and repeat dose of neostigmine 0.5 mg with atropine every 30 minutes for 5 doses (In children, Inj. Atropine 0.05 mg/kg followed by Inj. Neostigmine 0.04 mg/kg **Intravenous** and repeat dose 0.01 mg/kg every 30 minutes for 5 doses). A fixed dose combination of Neostigmine and glycopyrolate IV can also be used.
- Thereafter to be given as tapering dose at 1 hour, 2 hour, 6 hours and 12 hour. Majority of patients improve within first 5 doses. Observe the patient closely observed for 1 hour to determine if the neostigmine is effective. After 30 minutes, any improvement should be visible by an improvement in ptosis. Positive response to "AN" trial is measured as 50% or more recovery of the ptosis in one hour.
- Stop Atropine neostigmine (AN) dosage schedule if:
 - Patient has complete recovery from neuromuscular paralysis. Rarely patient can have recurrence, carefully watch patients for recurrence.
 - Patient shows side effects in the form of fasciculations or bradycardia.
 - If there is no improvement after 3 doses.
- Improvement by atropine neostigmine indicates Cobra bite. A few Nilgiri Russel's viper bites victims also improve with this regimen.
- Give one dose of "AN" injection before transferring to the higher centre. Rapid deterioration of Cobra bite neurotoxic syndrome may kill the patient on the way to transfer.

- If there is no improvement after 3 doses of atropine neostigmine (within 1 h), this indicates probable Krait bite. Krait affects pre-synaptic fibres where calcium ion acts as neurotransmitter. Give Inj. Calcium gluconate 10ml IV (in children 1-2 ml/kg (1:1 dilution) slowly over 5-10 min every 6 hourly and continue till neuromuscular paralysis recovers which may last for 5-7 days.

4.8 MANAGEMENT OF VASCULOTOXIC SNAKEBITE:

- Strict bed rest to avoid even minor trauma.
- Screen for hematuria, hemoglobinuria, myoglobinuria by Dipstick method. Dipstick test is positive in all three presentations listed above. Centrifuged urine showing pink color indicates hemoglobinuria, clear supernatant (RBCs settle down as deposit) indicates myoglobinuria.
- Closely monitor urine output and maintain 1 ml/kg/h urine output.

4.8.1 Volume Replacement in snake bite:

- If the patient has intravascular volume depletion, indicated by supine or postural hypotension, or empty neck veins, proceed as follows:
- Establish intravenous access.
- Give fluid challenge: An adult patient can be given two litres of isotonic saline over one hour or until the jugular venous pressure/central venous pressure has risen to 8-10 cm above the sternal angle (with the patient propped up at 45°).
- Observe the patient closely while this is being done. The fluid challenge must be stopped immediately if pulmonary oedema develops.

4.8.2 Forced Alkaline Diuresis

- If the patient has oliguria or dipstick positive for blood give a trial of forced alkaline diuresis (FAD) **within first 24 hours of the bite** to avoid pigment nephropathy leading to acute tubular necrosis (ATN).
- **Delayed FAD has no role.**
- Sequence of FAD in adults is as follows:
 - Inj. Frusemide 40 mg IV stat
 - Inj. Normal saline 500 ml + 20 ml of NaHCO₃ over 20 minutes
 - Inj. Ringer's lactate 500 ml + 20 ml of NaHCO₃ over 20 minutes
 - Inj. 5% dextrose 500 ml + 10 ml of Potassium Chloride over 90 minutes
 - Inj. Mannitol 150 ml over 20 min
- Whole cycle completes in 2 h 30 min and urine output of 3 ml/min is expected.

- **If patient responds to first cycle continue for 3 cycles.** FAD converts oliguria into polyuria and avoid ATN and acute kidney injury needing dialysis in more than 75% patients.
- **If there is no response to furosemide discontinue FAD** and refer patient immediately to a higher center for dialysis.
- **Indications for dialysis are:**
 - Absolute value of Blood urea >130 mg/dl (27 mmol/L) (BUN 100 mg/dl), Sr. Creatinine > 4 mg/dl (500 µmol/L) OR evidence of hypercatabolism in the form of daily rise in blood urea 30 mg/dL (BUN > 15), Sr. Creatinine > 1 mg/dL, Sr. Potassium > 1 mEq/L and fall in bicarbonate >2 mmol/L
 - Fluid overload leading to pulmonary oedema
 - Hyperkalaemia (>7 mmol/l (or hyperkalaemic ECG changes)
 - unresponsive to conservative management.
 - Uremic complications – encephalopathy, pericarditis.
- Haemodialysis is preferable in cases of hypotension or hyperkalaemia. Peritoneal dialysis can be performed at a secondary health care center. Continuous renal replacement therapies and intermittent hemodialysis are equivalent in patients with severe sepsis and acute renal failure because they achieve similar short-term survival rates.
- Continuous therapies are recommended to facilitate management of fluid balance in hemodynamically unstable patients. An efficient dose for continuous renal replacement therapy would be 20 to 25 mL/kg/h of effluent generation.

4.8.3 In case of *Shock, myocardial damage*:

- Correct hypovolaemia with colloid/crystalloids, controlled by observation of the central venous pressure.
- Infusion of isotonic crystalloids or albumin, with boluses of up to 20 ml/kg for crystalloids (or albumin equivalent) over 5 to 10 mins titrated to reversing hypotension, increasing urine output, and attaining normal capillary refill, peripheral pulses and level of consciousness without inducing lung crepitations or hepatomegaly.
- If hepatomegaly or rales develop, initiate inotropic support with dopamine or dobutamine. If patient doesn't respond to fluid resuscitation, inotropic support must be given.

- In sepsis, noadrenaline is the inotropic agent of choice. Treat patients with hypotension associated with bradycardia with atropine.
- **For coagulopathy** – in case of prolonged CT, PT, aPTT administer fresh frozen plasma (FFP) infusion. Associated low platelets indicates consumptive coagulopathy and disseminated intravascular coagulopathy (DIC). To confirm fibrinogen level FDP should be estimated. Low fibrinogen and high FDP will require fibrinogen/FFP supplementation. Bleeding leads to anaemia, PCV of 30% must be maintained, therefore, measure serial PCV every 4 – 6 h depending upon bleeding severity of patients. If PCV is lower than 30 needs blood transfusion/PCV transfusion.
- Avoid intramuscular injections.
- FFP administration after ASV administration results in more rapid restoration of clotting function in most patients, but no decrease in discharge time. Early FFP administration (< 6-8 h) post-bite is less likely to be effective. Administer 10-15 ml/kg of FFP within over 30–60 min within 4 hours of ASV administration. The aim should be a return of coagulation function, as defined by an INR of < 2.0, at 6 h after ASV administration was commenced. Non –response to FFP can occur with use of FFP that has low activity of FV and FVIII, because of either poor storage or premature thawing (> 24 hours) prior to administration.
- **Heparin** is ineffective against venom-induced thrombosis and may cause bleeding on its own account. It should never be used in cases of snakebite. **Antifibrinolytic agents** are not effective and should not be used in victims of snakebite.

4.9 MANAGEMENT OF SEVERE LOCAL ENVENOMING

- Local necrosis, intracompartmental syndromes and even thrombosis of major vessels is more likely in patients who cannot be treated with ASV.
- Surgical intervention may be needed but the risks of surgery in a patient with consumption coagulopathy, thrombocytopenia and enhanced fibrinolysis must be balanced against the life -threatening complications of local envenoming.
- Give prophylactic broad-spectrum antimicrobial treatment for cellulitis after completion of first 10 vials of ASV) is as following.
 - Inj. Amoxicillin+ clavulanic acid 1.2 g IV thrice daily for first 7 days then switch to oral therapy Tab. Amoxicillin+clavulanic acid 625 mg three times a day for further 3-7 days; In children, the dose is 100 mg/Kg/day in three divided doses intravenously; for oral therapy, the dose is 50

mg/kg/day in three divided doses.

- Inj. Metronidazole 400 mg IV infusion thrice daily for 7 days; in children- 30 mg/kg/day in 3-4 divided doses.
- Alternatively Inj Ceftriaxone 1 g IV twice daily (in children the dose is 100 mg/kg/day in two divided doses) for 7 days if Amoxicillin+clavulanic acid is not available. Both Amoxicillin+ clavulanic acid and Ceftriaxone are mainly excreted through Kidney. Therefore, in case of acute kidney injury in Viper bites dose of both these antibiotics should be reduced and adjusted according to renal function.

4.10 Recovery phase or observation of the response to adequate dose of antisnake venom

- Response to infusion of ASV is marked by normalization of blood pressure. Within 15–30 min bleeding stops, though coagulation disturbances may take up to 6 h to normalize.
- Neurotoxic envenoming of the postsynaptic type (Cobra bites) begins to improve within the first 30 min, but patients may require 24–48 h for full recovery. Envenoming with presynaptic toxins (Kraits and sea snakes) do not respond in this way usually takes a considerable time to improve.
- Nausea, headache and generalised aches and pains may disappear very quickly.
- In shock patients, blood pressure may increase within the first 30-60 minutes and arrhythmias such as sinus bradycardia may resolve.
- Active haemolysis and rhabdomyolysis may cease within a few hours and the urine returns to its normal colour. However, red colour urine may persist for several days in spite of adequate ASV treatment due to damage of renal papillae, no further ASV can help.

4.11 Other measures

- Clean the bitten site with povidone-iodine solution, but do not apply any dressings.
- Leave blisters alone. Allow them to break spontaneously and heal. If there is local necrosis, excise and apply saline dressings. Surgical decompression may be necessary in some cases.
- Administer booster dose of Tetanus toxoid injection, if not vaccinated earlier or vaccination history is not reliable after correction of coagulopathy.

- For mild pain, in adults Paracetamol 500-1000 mg (in children 10-15 mg/kg) every 4-6 hourly orally. Do not use aspirin or other non steroidal anti-inflammatory drugs (NSAIDs). In case of severe pain in adults, Tab. Tramadol 50 mg or Inj. Tramadol 50 mg IV and in children Ibuprofen cautiously 5-10 mg/kg/dose every 8 hourly.
- Maintain hydration and nutrition.
- If there is local pain and spreading oedema, elevate the affected limb and allow it to rest on a sand bag.
- Morbidity and mortality depends on the age and size of victim (children receive larger envenomation relative to body size), co morbid conditions (elderly patients succumb more easily to snake venom) as well as nature of first aid given. Factors not contributing to outcome are size of the snake and time of bite (day/night)

4.12 SURGICAL PROCEDURES IN SNAKEBITE

4.12.1 Debridement of necrotic tissue

- Refer the victim to a facility that can perform surgery and is equipped with a surgeon. It is worth waiting 5-7 days before commencing a debridement of necrotic tissue in order to specify the line of demarcation between viable and non-viable tissue.
- Skin grafting and amputation of a necrotic digit may be required in some cases of snakebite. Refer these cases to the Surgeons after completion of Antisnake venom treatment. Surgical interventions in these cases are in the general principles of surgery, not much related with Antisnake venom therapy.

4.12.2 Compartmental syndrome

Clinical features of a compartmental syndrome

Compartment syndrome is diagnosed with 5 'P' –

- Pain (severe)
- Pallor
- Paraesthesia
- Pulselessness
- Paralysis or weakness of compartment muscle.

4.12.3 Criteria for fasciotomy in snakebite limb

- Haemostatic abnormalities have been corrected

- Clinical evidence of an intracompartmental syndrome
- Intra-compartmental pressure >40 mmHg of normal saline (in adults). Compartment pressure can be measured bed side using 3 way cannula – 16 G needle attached to one end, BP apparatus attached to 2nd end and saline infusion on 3rd side (Figure 9).
- This can be confirmed by vascular Doppler and rising CPK in thousands. Timely fasciotomy decreases the need for repeated dialysis.

Early treatment with antsnake venom (ASV) remains the best way of preventing irreversible muscle damage. In any case, fasciotomy should not be contemplated until haemostatic abnormalities have been corrected (with ASV or without clotting factors), otherwise the patient may bleed to death. Antsnake venom may also be helpful in reducing severe limb oedema (Rojnuckarin et al., 2006). Corticosteroids should not be used as they are not effective in ameliorating local effects of envenoming and carry the risk of side-effects (Reid et al., 1963; Nuchprayoon et al., 2008).

Compartment pressure measurement procedure is shown in Figure 10.

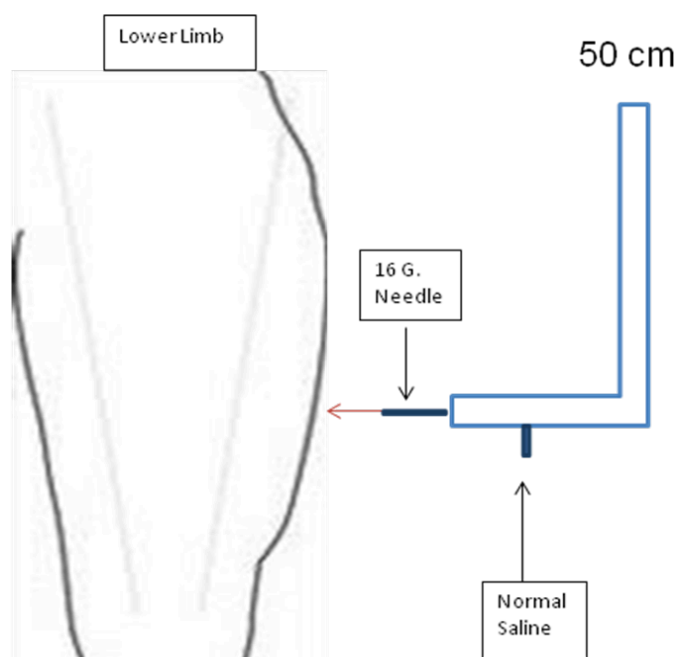


Figure 10. Compartment pressure measurement procedure.

- A simple instrument can be used for measurement of intra-compartmental pressure. Insert a 16 no. needle in the suspected compartment at a depth of

1 cm and connect to a simple tubing irrigated with normal saline. Measure rise in the saline column in the tubing. A rise more than 40 cm of saline corresponds to 30mm Hg of Lymphatic/ capillary pressure and is suggestive of compartment pressure. This necessitates fasciotomy procedure.

- Refer the patient to a surgical specialist but it is worth the treating clinician ensuring that objective criteria are used to assess the actual intracompartmental pressure in the limb (A2).
- The limb can be raised in the initial stages to see if swelling is reduced. However, this is controversial as there is no trial evidence to support its effectiveness.
- Persistent moderate swelling of the limb after viper bite can be successfully managed by systemic broad spectrum antibiotics and repeated Magnesium Sulphate compresses (in the layers of wet bandage, changed 2-3 times a day) for 5-7 days.

4.13 Discharge

If no symptoms and signs develop after 24 hours the patient can be discharged. Keep the patient under observation for 48 hours if ASV was infused.

4.14 Follow-up

A snakebite victim discharged from the hospital should continue to be followed up. At the time of discharge patient should be advised to return to the emergency, if there is worsening of symptoms or signs such as evidence of bleeding, worsening of pain and swelling at the site of bite, difficulty in breathing, altered sensorium, reduced or increased urine output etc. The patients should also be explained about the signs and symptoms of serum sickness (fever, joint pain, joint swelling) which may manifest after 5-10 days.

4.15 Rehabilitation

In patients with severe local envenoming, the limb should be maintained in a functional position. For example, in the leg, equinus deformity of the ankle should be prevented by application of a back slab.

Functional effects of local envenoming range from persistent stiffness and induration due to sclerosis of veins, lymphatics and tissue planes through which the venom has spread, to severe deformity, tissue loss, especially dermonecrosis, and requiring skin grafting and gangrene requiring debridement and amputation. Restoration of normal function in the bitten part should be started by simple exercises while the patient is

still in hospital. After the patient has been discharged from hospital rehabilitation is rarely supervised but relatives can be instructed and given a time table of rehabilitation activities. Conventional physiotherapy may accelerate functional recovery of the bitten limb.

5. LEVEL SPECIFIC MANAGEMENT OF SNAKEBITE

5.1 REFERRAL CRITERIA

5.1.1 Vasculotoxic envenomation

- If no ASV is available, transfer to a hospital (where ASV availability is confirmed over the phone).
- If 20 WBCT is “not clotted” after loading dose of 10 vials of ASV as in case of Viper bite.
- If patient is continuing to bleed even after full dose of ASV transfer to a tertiary care medical college or higher level of health facility.
- Progressive septicaemia
- Signs of kidney injury or abnormal kidney function test transfer to a tertiary care medical college or higher level of health facility.

5.1.2 Referral Criteria: Neurotoxic Envenomation

- Progressive neuromuscular paralysis - transfer with life support in ambulance for mechanical ventilation. Whilst it is entirely possible to maintain a neurotoxic victim by simply using a resuscitation bag, this should always be used as a last resort; the ideal means of support remains a mechanical ventilator (*Battery operated Transport Ventilator*) operated by qualified staff.
- PHC and even many referral hospitals are not equipped with mechanical ventilators. The most important factor, therefore, is when to refer a patient to a hospital with a ventilator.
- The key criteria to determine whether respiratory failure, requiring mechanical ventilation is likely, is the ‘neck lift’ to elicit broken neck sign. Neurotoxic patients should be frequently checked on their ability to perform a neck lift. If they are able to carry out the action then treatment should continue until recovery in the PHC. Neck lift test is also useful for children except very young children who may not be able to follow commands. Other tests which indicate descending paralysis are declining single breath count,

pooling of saliva.

- If the patient reaches the stage when patient cannot do neck lift immediately refer the patient to a hospital with a mechanical ventilator.
- Maintain oxygen saturation using Pulse oximetry. Oxygen saturation <90% patient indicates requirement for ventilator support.



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, neuroparalysis persisted for five days despite antivenom treatment, but without progression toward respiratory failure. H. S. Bawaskar. doi:10.1371/journal.pntd.0000603.g002

5.1.3 Instructions while referring

- Inform the need for referral to the patient and/caregiver (family member or the accompanying attendant).
- Give prior intimation to the receiving centre using available communication facilities.
- Arrange for an ambulance. Call Emergency helpline 102/108 etc. Transport in an ambulance equipped with transport ventilator. If ventilator is not available tight-fitting face mask connected to an anaesthetic (Ambu) bag

should be available. However, do not waste time to get an ideal ambulance. Motorbike is a practical alternative in rural areas for rapid transport but third person must sit behind the patient to support on bike.

- If ASV is not available at First contact centre transfer to the nearest health facility where ASV is available confirmed by telephone.
- Transfer to a higher health facility (Secondary Care Hospital or Tertiary Care Hospital) where mechanical ventilator and dialysis facilities are available for dialysis and ventilation, **if required after completion of ASV infusion only.**
- During transfer, continue life-supporting measures, insert nasogastric tube and provide airway support with the help of an accompanying staff, if required.
- Send the referral note with details of treatment given clearly mentioning the clinical status at the time of referral.

5.2 SNAKE BITE MANGEMENT AT A PRIMARY HEALTH CARE CENTER (PHC)

Patient Arrival & Assessment

1. Assess circulation, airway and breathing and deal with any life threatening symptoms on presentation.
2. Establish large bore intravenous access and start normal saline slow infusion.
3. Before removal of the tourniquet/ligatures, test for the presence of a pulse distal to the tourniquet. If the pulse is absent ensure a doctor is present before removal or ligatures.
4. **In case of clinically confirmed venomous bite, tourniquet should be removed only after starting of loading dose of ASV and keep Atropine Neostigmine injection ready.** In case of multiple ligatures, all the ligatures can be released in Emergency Room EXCEPT the most proximal one; which should only be released after admission and all preparations.
5. Carry out a simple medical assessment including history and simple physical examination – local swelling, painful tender and enlarged local lymph glands, persistent bleeding from the bite wound, blood pressure, pulse rate, bleeding (gums, nose, vomit, stool or urine), level of consciousness, drooping eyelids (ptosis) and other signs of paralysis. The Glasgow Coma scale cannot be used to assess the level of consciousness of patients paralyzed by neurotoxic venoms.
6. The snake, if brought, should be carefully examined and identified, if possible. (One smart phone photograph of the snake, dead or alive, if available, should be taken for confirmation by an expert).
7. Clotting test '20WBCT' in clean, new, dry, glass test tubes should be carried out to diagnose vasculotoxic envenomation. Report should be given as Clotted or Not Clotted. Never write Positive/negative. If clotted continue every 1 hour for the

- 1st 3 hours from the time of hospitalization and then 6 hourly for 24 hours. If a neurotoxic snakebite is confirmed, clotting test can be repeated after 6 hours. If not clotted administer antsnake venom (ASV).
8. Give analgesia by mouth if required: Paracetamol (acetaminophen) (adult dose 500 mg to 1 g maximum 4 g in 24 hours; children 10-15 mg/kg/dose (maximum 100mg/kg/day). Do NOT give aspirin or non-steroidal anti-inflammatory drugs which can cause bleeding and renal dysfunction.
 9. Assess the need and feasibility of transporting the patient to a higher level of the health service (see A above).
 10. If the necessary skills, equipment, antivenom and other drugs are available, give intravenous fluid to correct hypovolaemic shock. These skills include ability to diagnose local and systemic envenoming, set up intravenous infusion or intravenous injection, identify the early signs of anaphylaxis.
 11. If the patient fulfils criteria for antivenom treatment, give ASV. If no ASV is available, transfer to a health facility where ASV is available.
 12. Adrenaline is made ready in two syringes of 0.5mg (1:1000) for IM administration if symptoms of any adverse reaction appear. If symptoms do appear, ASV is temporarily suspended while the reaction is dealt with and then recommenced (for details see treatment of early ASV reactions).
 13. If the patient has evidence of respiratory paralysis, give oxygen by mask or laryngeal mask airway (LMA), and intubate the patient and make arrangements for transfer to a higher facility accompanied by a Medical Officer carrying an Ambu bag, additional endotracheal tubes, oxygen, facemasks and basic drugs for resuscitation. During the journey the endotracheal tube may slip into right bronchus leading to left lung collapse and right side pneumothorax may also occur. To prevent the tube being bitten, a mouth gag should be inserted. The tube may get obstructed due to secretions or kinking leading to cyanosis and resistance to Ambu-ventilation. Then the tube should be pulled out immediately and Ambu- ventilation could be continued with a face mask.

Administer Atropine and Neostigmine before transferring to a hospital as recommended above.

14. It is assumed that assisted ventilation other than by a tight-fitting face mask connected to an anaesthetic (Ambu) bag will not be possible at this level.
15. While admitted for observation, IV fluid with a slow plain drip of Normal saline should be started, and a Tetanus Toxoid given after ruling out or correction of coagulopathy.
16. Patient should be placed under observation for 24 hours (even if the victim gives a history of a nonvenomous snakebite. The bite victim becomes so frightened and confused immediately after a bite, many a time gives false

identification history). If no symptoms develop after 24 hours the patient can be discharged.

17. Discourage the use of ineffective and potentially harmful drugs such as corticosteroids, antihistamines, and heparin.



5.3 SNAKE BITE MANGEMENT AT THE DISTRICT HOSPITAL

Proceed as in B above in addition to the followings:

1. If ASV indicated and had not been given already start without any delay, do not wait for any test report.
2. Carry out a more detailed clinical and laboratory assessment including biochemical and haematological measurements, ECG or radiography, as indicated to get a baseline data.
3. If the patient is bleeding severely irrespective of full dose of ASV or is already seriously anaemic give transfusion of blood or fresh frozen plasma or transfer where facility is available.
4. Reassess analgesia (see B above) and, if required, consider giving Tramadol 50 mg orally. In case of severe pain administer Inj. Tramadol 50 mg IV. **Avoid pethidine or morphine in neurotoxic envenomation. A deeply sedated patient may create confusion regarding level of neuro-paralysis.**
5. Give tetanus toxoid booster (if not given already), to all snakebite victims provided coagulation is restored.
6. In case of cellulitis consider antibiotics, and consider surgical debridement of dead tissue.
7. If the patient has evidence of acute kidney injury (AKI), treat with dialysis. If this is not available, transfer to a specialized hospital. For details see Annexure.
8. If the patient has evidence of bulbar or respiratory paralysis, insert endotracheal tube with the help of the anesthesiologist if available or by a

trained medical personnel or laryngeal mask airway (LMA). If there is evidence of respiratory failure, assist ventilation manually by anaesthetic bag or mechanical ventilator.

9. **Initial dose of ASV is administered over 1 hour. The first blood drawn from the patient should be typed and cross-matched, as the effects of both venom and ASV can interfere with later cross-matching.**
10. Atropine neostigmine "AN" challenge test is administered using 0.6mg of atropine IV first followed by 1.5 mg of neostigmine IV (Schedule described above). Rarely, if patient require more than 2nd dose of AN test. Stop after 3rd dose if there is no response. In Krait bite practice of continuing Neostigmine drip till ptosis persists beyond 24 h is not beneficial. Pre-synaptic blockage by Krait venom does not respond to AN injection.
11. If after 2 hours from the end of the first dose of ASV, the patient's symptoms have worsened i.e. paralysis has descended further, a second full dose of ASV is given over 1 hour.

5.4 SNAKE BITE MANGEMENT AT THE TERTIARY CARE OR MEDICAL COLLEGE

Proceed as in B and C above in addition to the followings:

1. In the ICU, the standard protocol should be followed during assisted ventilation and the patient should be monitored for all parameters including level of consciousness.
Avoid drugs such as sedatives, morphine and neuromuscular blocking agents. Some patients go into a deep coma state but recover completely. Hence, diagnosis of brain death should not be considered.
Recovery of respiratory muscles is reflected by improvement of neck flexors where flexing the neck against gravity indicates timing to wean off ventilation. Prophylactic antibiotics are unnecessary.
2. Multiple organ failure. Management is supportive, and prevention of organ damage in those at risk are therefore crucial. Aggressive early resuscitation, adequate antivenom therapy, excision of devitalized tissue and treatment of infection are important. Prompt recognition of organ dysfunction and immediate intervention may reverse organ impairment and improve the outcome.
3. If the patient has evidence of acute kidney injury peritoneal or haemodialysis or haemofiltration. Indications for dialysis as described above.
4. More advanced surgical management of local necrosis (e.g. split skin grafting).
5. More advanced investigations including bacterial cultures and imaging (CT scans) as indicated.
6. CNS complication and intracranial bleeding to be managed according to the standard practice. Neurosurgical opinion may be requested according to

- intracranial pathology. However, haemostatic abnormalities must be corrected.
7. **Coma, autonomic dysfunctions.** Patient in deep coma recovers fully provided there is no hypoxic brain damage. Autonomic dysfunctions are transient and don't need treatment. Sometimes treatment might be harmful e.g. treating with antihypertensive drugs to lower the increased blood pressure due to sympathetic hyperactivity.
 8. **Uncommon complications such as hepatic dysfunction, pancreatitis, endocrine insufficiency and deep venous thrombosis** should be managed according to the standard practice.
 9. Implement rehabilitation by physiotherapists.

6. PATIENT INFORMATION SHEET

- If discharged within 24 hours, advise the patient to return if there is any worsening of symptoms such as bleeding, pain or swelling at the site of bite, difficulty in breathing and altered sensorium.
- Also explain to the patient about serum sickness which may manifest after 5-10 days.

Prevention of snakebites

Snakebite is invariably an accident. As it is an accident, it can be avoided in many cases. Some judicious, timely precautions are extremely important to avoid the risk of snake – bites. People should be aware of such preventive measures.

Education: Know your local snakes, know the sort of places where they like to live and hide, at what times of year, at what times of day/night or in what kinds of weather they are most likely to be active.

Learn when and where snakes may be found:

- Snakes rest in cool, shaded areas during hot weather.
- Snakes are predatory carnivores, but they are also preyed upon by other animals including snakes. For their preying habits and survival tactics, they tend to be secretive. Snakes avoid confronting larger animals and humans.
- Avoid snakes as far as possible, including snakes performing for snake charmers.
- Never handle, threaten or attack a snake and never intentionally trap or corner a snake in an enclosed space.
- Do **NOT** put your hands or fingers or feet into holes or nest or places you cannot see or any hidden place, where snakes may live.

- Most of the snakebites occur in the rainy season and after flood, because snakes are compelled to come out from their living and hiding places. Be especially vigilant about snakebites during the rainy season and after flood, and take adequate precautions while walking on the roads and fields.
- Much snakebites are encountered during ploughing, planting and harvesting.

Leave snakes alone:

- Do **NOT** try to catch, frighten, or attack a snake.
- Back away and do **NOT** try to touch the snake. They do not attack man unless they are handled, threatened, trapped or cornered or their body parts are touched unintentionally (such as pressed down or crushed with the foot inadvertently).
- Do **NOT** pick up a dead snake or that appears to be dead. Even an accidental scratching from the fang of a snake's severed head may inflict deadly poison.
- Even dead snakes can deliver venom through their fangs. Rattlesnakes shake the ends of their tails to make a rattle sound that warns that it feels threatened. If you hear a rattlesnake, move away quickly.

Learn what poisonous snakes look like

- People of a locality should know what sort of snakes (both venomous and non – venomous) are existing there, the habits of those snakes, their living and hiding places, at what time of year and at what time of day or night they are most likely to be out and active.
- Snake charmers and snake handlers carry greater risk of snakebite. Avoid free hand handling of venomous snakes; adequate equipment must be used for handling.
- In snake restaurants, staff and customers may sometimes be bitten by snakes accidentally.
- Sea snakes may sometimes be caught in nets. Fishermen are advised not to touch those snakes.
- Venomous snakes are born fully equipped with venom and fangs. Young snakes are more pugnacious and ready to defend themselves, so do not discount a snake going by its size.

Dress to protect yourself:

- Wear shoes or boots and pants to protect your feet and legs.
- Always check footwear before wearing them.
- Identify major situational sources of bites; walk at night with sturdy footwear (preferably with high boots) and use a torch while walking outside the house or visit the latrine (outdoor) at night.

Outdoor

- Light your path: Use a flashlight or lamp when you walk outside at night. Do **NOT** walk in areas where you cannot see the ground.
- Do not step or reach into an area where you cannot see the ground.
- When walking, walk with a heavy step as snakes can detect vibration and will move away.
- Carry a stick when grass cutting or picking fruit or vegetables or clearing the base of trees. Use the stick to move the grass or leaves first. Give the snake a chance to move away. If collecting grass that has previously been cut and placed in a pile, disturb the grass with the stick before picking the grass up.
- Keep checking the ground ahead while cutting crops like millet, which are often harvested at head height and concentration is fixed away from the ground.
- Pay close attention to the leaves and sticks on the ground when collecting wood.
- Try to avoid sleeping on the ground. Use bamboo cot and scrupulous use of a mosquito net can prevent snakebites, scorpion stings, and mosquito bites alike. If you have to sleep on the ground use mosquito net that is well tucked in under the mattress or sleeping mat.
- Avoid defecation in open field. If unavoidable carry torch or lamp.



- During trekking, etc. through forests or mountains, stay on clearly marked tracks.
- Step on to rocks or logs rather than straight over them – snakes may be sunning themselves on the sides.
- Avoid handling dead snakes, or snakes that appear to be dead. They can still inject venom!
- If you see a snake, do nothing; let it go. Keep a distance, it is better to run away. Snakes cannot attack when it is about 25 – 30 ft away.
- Do not try to pick it up or kill it. Snakes prefer not to confront large animals such as humans so give them the chance to slither away.

The Garden or Compound

- Clear heaps of rubbish, building materials and termite mounds.
- Clear any bush or jungle.
- Keep grass short or cleared.
- Close rat holes.

Indoor

- In the house: Do not keep livestock, especially chickens, in the house, as snakes may come to hunt them.
- Regularly check houses for snakes and, if possible, avoid those types of house construction that will provide snakes with hiding.
- Store food in rat-proof containers.
- Also keep animal feed and rubbish away from your house. They attract rats and snakes follow.
- There is no chemical/onions which can effectively repel snakes. Bleaching powder or gammaxane may be spread which may to some extent prevent the entry of snake in the house as they repel small creatures like rat and frog; snakes would not come following them.
- Seal any rat hole in and around the houses.
- Meticulously observe heaps of fire woods, cow dung cakes and similar materials at first and then handle.
- Keep plants away from doors and windows. Snakes like cover and plants help them climb up and into windows.
- Do **NOT** have tree branches touching the house. Keep grass short or clear the ground around the house and clear low bushes in the vicinity so that snakes cannot hide close to the house.
- Inspect mud made ovens or chulhas at first before cleaning.
-

During construction of new house

- Indoor toilets should be made compulsory at the time of issuing permission for new housing construction.

After snakebite occurs Do's and Don'ts

Do's

- Seek medical help right away.
- Call ambulance and transfer patient to a medical health facility. Arrange transport of the patient to medical care as quickly, safely and passively as possible by vehicle ambulance (toll free no. 102/108/etc.), boat, bicycle, motorbike, stretcher etc.
- Keep the person calm. Reassure them that bites can be effectively treated in an emergency room. Restrict movement, and keep the affected area below heart level to reduce the flow of venom.

- Remove any rings or constricting items, because the affected area may swell.
- Create a loose splint (it should be capable of inserting one finger beneath) to help restrict movement of the area.
- Ideally the patient should lie in the recovery position (prone, on the left side) with his/her airway protected to minimize the risk of aspiration of vomitus.
- If the area of the bite begins to swell and change colour, the snake was probably venomous.
- Monitor the person's vital signs -- temperature, pulse, rate of breathing, and blood pressure -- if possible. If there are signs of shock (such as paleness), lay the person flat, raise the feet about a foot, and cover the person with a blanket.

Don'ts

- Do **NOT** waste time in traditional first aid methods
- Do **NOT** allow the person to become over-exerted. If necessary, carry the person to safety.
- Do **NOT** apply a tourniquet. Do **NOT** block the blood supply or apply pressure.
- Do **NOT** apply cold compresses to snakebite.
- Do **NOT** cut into a snakebite with a knife or razor.
- Do **NOT** try to suck out the venom by mouth or wash the wound.
- Do **NOT** give the person stimulants or pain medications unless a doctor tells you to do so.
- Do **NOT** give the person anything by mouth.
- Do **NOT** raise the site of the bite above the level of the person's heart.
- Do **NOT** attempt to kill or catch the snake as this may be dangerous. Bring in the dead snake only if this can be done safely. Do **NOT** waste time hunting for the snake, and do **NOT** risk another bite if it is not easy to kill the snake. Be careful of the head when transporting it - a snake can actually bite for several hours after it is dead (from a reflex).

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8. SNAKE BITE EXAMINATION PERFORMA

Name Age Sex M/F

Address

Datetime of biteActivity at time of bite

Sleeping on floor bed ... Yes/No Cot Yes/No Mosquito net Yes/No

Snake Seen Yes/No Killed Yes/No Specimen photo in mobile Yes/No

Identification of snake in photos specimen as

Confirmed specimen of snake

Local site

Fangs marksActive bleeding from fangs Yes/No Blood clot Yes/No

Time of development of edema

Extension of edema

Regional lymphangitis

Pain in abdomenVomiting

Blood pressure Pulse rate

Active bleeding Gum/ from abrasions /any other site

20WBCT on arrival Clotted /Not clotted Time.....

Repeat 20WBCT Clotted /Not clotted Time.....

Repeat 20WBCT Clotted /Not clotted Time.....

ASV administered **Dose given** **Time**.....

Repeat 20WBCT **after ASV** Clotted /Not clotted

Progress after ASV

20WBCT at 1h2h.....3h.....6h.....12h.....18h.....24h...

Progress INRAPTT

Blood urea

Serum creatinine

Urine Haematuria /hemoglobinurea

HaemogramPlatelet count.....

Blood transfusion, if any

Fresh Frozen Plasma (FFP), if any

Dialysis, if any

Compartment syndrome Present/Not present**Neuromuscular symptoms**

Bilateral Ptosis

Bulbar palsy

Ophthalmoplegia

Respiratory rate/min

sPO₂

One minute count

Muscle power on arrival

Upper limblower limb Progress

Pelvic girdle

Reflexes Planter on arrivalProgress

Voice on arrival

Distance between Inter teeth marginOn arrival Progress

Protrude of tongue in relation to teeth marginOn arrivalprogress

Pupil size reacting to light..... On arrival.....

Progress after ASV total doseAfter Repeat dose

Intubation timeAmbu bag ventilation/ Mechanical ventilator

Follow up

Recovery time in days..... Total ASV dose given.....

Blood transfusion given/not given

FFP given/not given

Dialysis days

Ventilations total days.....

Disability

Hypoxic brain injury

Amputation of limb

Plastic surgery

STANDARD TREATMENT GUIDELINES

Management of Snake Bite

Quality Standards & Indicators
January 2016



सत्यमेव जयते

Ministry of Health & Family Welfare
Government of India

Quality Standards for Management of Snakebite

Standard	Statement
Quality Standard 1 Observation	All patients reporting to health facility with history of snake bite/ suspected snake bite are kept under clinical observation for at least 24 hours irrespective of severity of envenomation
Quality Standard 2 Diagnosis	For all patients with sign of envenomation, 20-minute whole blood clotting (20 WBCT) test is done immediately after admission, repeated hourly for first 3 hours.
Quality Standard 3 Initiation of ASV Therapy	All patients with Snakebite, confirmed clinically with neuromuscular symptoms or non clotting 20 WBCT are immediately provided Anti Snake Venom therapy
Quality Standard 4 Care of Neurotoxic envenomation	All snake bite patients presenting with neuromuscular symptoms are immediately admitted to ICU or referred to higher facility with ICU
Quality Standard 5 ASV Dose	All patients with confirmed diagnosis of snakebite are administered 10 vials of polyvalent ASV within 30 min of confirmation for indication/admission.
Quality Standard 6 Atropine Neostigmine Therapy	All patients with presentation of Neurotoxic (neuromuscular) Envenomation are provided AN (Atropine-Neostigmine) therapy as per schedule
Quality Standard 7 ASV Availability	24X7 Availability of Antisnake venom is ensured in designated health care facilities.
Quality Standard 8 Management of ASV Reactions	ASV reactions are monitored and treated and managed as per protocol
Quality Standard 9 Competence	Health care provider is competent and confident to manage snakebite cases
Quality Standard 10 Promotion	Health facility promotes the information and education regarding scientific management of snakebite in community

Quality Standard-1 - Admission and Observation of Suspected Snakebite Cases	
1. Statement	All patients reporting to health facility with history of snake bite/ suspected snake bite are kept under clinical observation for at least 24 hours irrespective of severity of envenomation
2. Rationale	Presenting Sign and symptoms of snake bite may be confusing the time of arrival to a health facility. Some patient with dry bite or no bite may mimic like a snake bite case due anxiety and sympathetic over activity. On the other hand, some cases their may be no sign or sign similar other common disease (Acute abdomen in case on occult snake bite. The definitive signs and symptoms of snake bite may manifest later. So it is judicious to keep all cases of suspected snake bit under observation at least for 24 hours.
3. Quality Measure	
3a. Structure	Evidence of availability of function indoor facilities and 24X7 nursing care at the facilities designated to treat snake bite.
3b. Process	Proportion of suspected snake bite cases reported to health facility that were kept under observation for at least 24 hours. Numerator - Total no patients with suspected snakebite kept under observation for 24 hours Denominator - Total no. of suspected snake bite cases reported to the facility.
3c. Outcome	Proportion of Snake bite cases re-admitted for sign and symptoms after early discharge (Before 24 hours) Numerator - Total No. of Patients readmitted after early discharge (before 24 hours of reporting) Denominator –Total No. of suspected Patients discharged before 24 hrs of reporting)
4. What Quality Measure means for each audience	Service Provider –Ensure that all the suspected cases of snake bite are kept under observation at least for 24 hours Health Administrator - Ensure that adequate indoor facility and nursing care is available at the designated facility. Patient and Community – Patient or their attendant should not not request hospitals staff for early discharge even if snake bite is not confirmed.
5. Data Source	Emergency Register Indoor Register
6. Definitions	Health Facility - Any Public health facility with provision of 24X7 indoor care (PHC, CHC, District Hospitals , Tertiary care Centers/ Teaching Hospitals) or their equivalent in private sector

Quality Standard-2 - Lab Diagnosis for Snakebite	
1. Statement	For all patients with sign of envenomation, 20-minute whole blood clotting (20 WBCT) test is done immediately after admission, repeated hourly for first 3 hours.
2. Rationale	20 Minute WBC test is the most definitive test to identify any venom-induced consumption coagulopathy. The test will help care provider in confirming the diagnosis and differentiating between neurotoxic and vasculotoxic snakebite. The test requires minimal resources (A syringe and a glass test tube) and skills so can be performed in at all level of facilities.
3. Quality Measure	
3a. Structure	Evidence of necessary consumables eg. Syringe and glass test tube is available and service providers are skilled for performing the test.
3b. Process	Proportion of suspected snake bite cases Immediately provided the 20 WBC Test after admission out of total suspected snake bite cases admitted Numerator - Total no patients provided immediate 20 WBC test after admission Denominator - Total no. of suspected snake bite cases admitted in the facility.
4. What Quality Measure means for each audience	Service Provider – Ensure that 20 WBC test is conducted as early as possible after admitting the snakebite patient and then repeated hourly for next three hours to rule out coagulopathy. Ensure nursing / paramedic staff are skilled to perform the test. A work instruction regarding this can be displayed at nursing station Health Administrators/ QA Officials -Monitor the related indicators. Periodic review of case records (Clinical Audit) Patient and Community – Cooperate with service providers and understand the need of reparative drawing of blood and conducting the test.
5. Data Source	Clinical Case records/ Bed Head Tickets of the sake bite cases
6. Definitions	20 WBCT - (20 Minute whole blood clotting test) performed by placing 2 ml freshly drawn venous blood in a small glass tube at ambient temperature and observing for coagulation after 20 minutes by tilting the test tube. “Not Clotted” blood is confirmation of venom induced consumption coagulopathy.

Quality Standard-3 - Initiation of Anti Snake Venom Therapy	
1. Statement	All patients with Snakebite, confirmed clinically with neuromuscular symptoms or non clotting 20 WBCT are immediately provided Anti Snake Venom therapy
2. Rationale	Anti Snake Venom therapy is the only specific treatment for snakebite cases. Once snakebite case confirmed based on clinical sign and symptom of envenomation or by lab test (20 WBCT) , ASV therapy should be started immediately without any other consideration. There are no contradictions to ASV. Early administration of ASV will stop the further progress of envenomation and even may reverse systemic envenomation abnormalities.
3. Quality Measure	
3a. Structure	Evidence of adequate stock of ASV is readily available for use and clinical staff is ASV therapy
3b. Process	Proportion confirmed snake bite cases initiated the antisnake venom therapy immediately out of total confirmed cases of snake bite cases attended Numerator - Total no of patients initiated antisnake bite therapy immediately (not more than 10 Minutes) after confirmation of envenomation. Denominator - Total no. of confirmed snakebite cases attended
3c. Outcome	Proportion of snake bite cases where mortality or severe morbidity occurred due to delay in initiation of Anti snake Venom therapy Numerator - Total no. of cases where mortality or severe morbidity occurred due to delay in initiation of Anti snake venom Denominator – Total no. of snake bite cases treated
4. What Quality Measure means for each audience	Service Provider – Ensure that adequate stock of ASV is readily accessible for use, including in night hours when pharmacy or drug store may be closed. Protocol regarding the immediate initiation of is effectively communicated and monitored. Health Administrators/ QA Officials - Monitor the related indicators. Periodic review of case records (Clinical Audit) Patient and Community – Insist on initiation of ASV therapy once diagnosis is confirmed. Community representative in rogi kalyan samities can periodically monitor the availability of anti snake venom in the hospital.
5. Data Source	Clinical Case records/ Bed Head Tickets of the snake bite cases Clinical Audit Records
6. Definitions	Antisnake Venom Therapy – Intravenous infusion of Polyvalent / Snake specific Anti snake venom with minimum dose of 100 ml.

Quality Standard-4 - Care of Patients with Neurotoxic Envenomation	
1. Statement	All snake bite patients presenting with neuroparalytic symptoms are immediately admitted to ICU or referred to higher facility with ICU after AN Injection
2. Rationale	Neuroparalytic Snakebite cases presenting can not only be managed with Antisnake Venom therapy. They will require intensive monitoring and may requires assisted life support If health facility is havening Intensive care unit with ventilators the patient should be immediately shifted ICU. Primary and secondary health care centers not havening ICU should refer the patient in an advance life support ambulance to the higher center immediately after giving Atropine – Neostigmine injection.
3. Quality Measure	
3a. Structure	<p>Evidence of functional Intensive Care unit with facility of mechanical ventilators are available at District Hospitals and above level of facilities</p> <p>Evidence that emergency department of facilities are equipped with life saving equipment like Oxygen, Laryngoscope and Bag & Mask are available</p> <p>Evidence of life saving emergency drugs e.g. Atropine and Neostigmine are available in facility</p>
3b. Process	<ul style="list-style-type: none"> Proportion of neuroparalytic snakebite cases referred to ICU/Higher facility out of total neuroparalytic cases received Numerator- Total no of neuroparalytic cases referred immediatly (not more than 30 minutes) of receiving the patients Denominator- Total no. of neuroparalytic snakebite cases attended Proportion of neuroparalytic snake bite cases given AN injection before refereeing to higher center Numerator- Total no. of cases AN (Atropine- Neostigmine) injection was administered before referring the patient Denominator – Total no. of neuroparalytic snakebite cases attended
4. What Quality Measure means for each audience	<p>Service Provider – Ensure timely shifting / referral of cases requires intensive care. Ensure that AN injection is given before referral</p> <p>Health Administrators/ QA Officials – Insure that ICUs are functional at district and above level facilities with mechanical ventilators. Emergency drugs and referral transport is available.</p> <p>Patient and Community – Cooperate and support the care providers in arranging the ambulance and referral of patient.</p>
5. Data Source	Clinical Case records/ Bed Head Tickets of the sake bite cases Handover registers, Ambulance records

6. Definitions	AN injection – Atropine 0.6 mg followed by neostigmine (1.5mg) to be given IV stat before referral
Quality Standard-5 - Adequate dose of anti snake venom	
1. Statement	All patients with confirmed diagnosis of snakebite are administered 10 vials of polyvalent ASV over 30 min
2. Rationale	Adequate and timely administration of ASV is key to successful management of snakebite. Irrespective of type of snake or sign and symptoms, 10 vials of ASV must be given over 30 minutes through IV infusion. Later doses will depend upon type of venom (Vasculotoxic or Neurotoxic) and extent of envenomation. Incomplete dose should never be given
3. Quality Measure	
3a. Structure	Evidence of adequate stock of ASV is readily available for use and clinical staff is trained for dosages of ASV therapy
3b. Process	Proportion confirmed snake bite cases given at least 10 vials of ASV over 30 minutes out of total snakebite cases treated. Numerator - Total no of confirmed snakebite patients initially given at least 10 vial of anti snake venom over 30 minutes Denominator - Total no. of confirmed snakebite cases attended
3c. Outcome	Proportion of snake bite cases successfully treated out of total snake bite cases attended Numerator - Total no. confirmed snake bite cases successfully treated Denominator – Total no. of confirmed snake bite cases attended
4. What Quality Measure means for each audience	Service Provider – Ensure that adequate stock of ASV is readily available. Protocol regarding the initial dosages of ASV is communicated and practiced. Health Administrators/ QA Officials - Monitor the related indicators. Periodic review of case records (Clinical Audit) Patient and Community – Insist on initiation of ASV therapy once diagnosis is confirmed. Community representative in rogi kalyan samities can periodically monitor the availability of anti snake venom in the hospital.
5. Data Source	Clinical Case records/ Bed Head Tickets of the snake bite cases Clinical Audit Records
6. Definitions	Antisnake Venom Therapy – Intravenous infusion of Polyvalent / Snake specific Anti snake venom with minimum dose of 100 ml.

Quality Standard-6 - Atropine Neostigmine Therapy for Neurotoxic Envenomation	
1. Statement	All patients with presentation of Neurotoxic (neuromuscular) Envenomation are provided AN (Atropine-Neostigmine) therapy as per schedule
2. Rationale	Neuromuscular Snakebite must be managed with AN therapy along with ASV. The dosages of AN therapy should be given as per guidelines for recovery of patients .
3. Quality Measure	
3a. Structure	Evidence of availability of Atropine and Neostigmine and clinical staff is skilled for AN therapy
3b. Process	Proportion of neuromuscular snake bite cases given complete AN therapy as per protocol Numerator - Total no. of neuromuscular snake bite cases given complete AN therapy Denominator – Total no. of neuromuscular snakebite cases attended
4. What Quality Measure means for each audience	Service Provider – Ensure AN therapy is given as per protocol. Health Administrators/ QA Officials – Ensure drugs and consumable are available and protocols followed.
5. Data Source	Clinical Case records/ Bed Head Tickets of the snake bite cases Handover registers, Ambulance records
6. Definitions	AN Therapy - Atropine 0.6 mg followed by neostigmine (1.5mg) to be given IV stat and repeat dose of neostigmine 0.5 mg every 30 minutes for 5 doses. Thereafter to be given as tapering dose at 1 hour, 2 hour, 6 hours and 12 hour

Quality Standard-7 - Antisnake Venom Availability	
1. Statement	24X7 Availability of Anti snake venom is ensured in designated health care facilities.
2. Rationale	Antisnake Venom is the only specific treatment for snake bite and saving life snake patients is directly linked for swift and adequate access to ASV. Indian Public Health Standards mandates availability of Lyophilized Polyvalent Antisnake Venom at Primary Health Centers and above level of facilities.
3. Quality Measure	
3a. Structure	Total no. of Stock out Days for Antisnake Venom (No . of days when ASV was not available added for month)
3b. Outcome	Proportion of patients denied treatment due to non availability of ASV Numerator - No. of Patients were denied treatment / referred to higher facility because of non availability / in adequate quantity of Anti snake venom Denominator - Total no. of suspected snake bite cases received in the facility
4. What Quality Measure means for each audience	Service Provider – Ensure that adequate stock of antisnake venom is always maintained at the facility. The optimal stock should take in account of usual case load and time taken to replenish the stock. Health Administrators/ QA Officials – Ensure that ASV is part of essential drug list. Availability of ASV is regularly monitored. Patient/ Community - Be aware of the facilities those have provision for Anti Snake Venom. Community representatives in Rogi Kaylan Samities should monitor the availability of ASV in concerned facility.
5. Data Source	Emergency Register, Case Records Drug Stock Register
6. Definitions	Primary Health Center - A health facility primary level of preventive , promotive and curative care to a population of around 25000. 24X7 PHCs usually have 6 bed indoor facility and can perform minor procedures.

Quality Standard-8 - ASV Reaction	
1. Statement	ASV reactions are prevented /managed as per protocol.
2. Rationale	20-60% of patients on ASV therapy may develop early or late reaction and rarely may manifest into life threatening anaphylaxis reaction. Some of these reactions may be prevented by avoiding unnecessary administration of ASV and use of aseptic precautions. Some of the reaction will still due ingredient and impurity in the ASV. These reactions should be managed by administration of drugs like Epinephrine and Chlorpheniramine Maleate
3. Quality Measure	
3a. Structure	Evidence that Drugs for treating ASV Reactions are available at designated facility for ASV therapy. Evidence that clinical staff has been trained for preventing and managing ASV reactions.
3b. Process	Proportion of ASV reactions treated with Epinephrine / Chlorpheniramine out of total ASV Reaction Numerator – No. of patients with ASV Reactions (Early or Late) treated with Epinephrine (0.5mg) and Chlorpheniramine (10mg) Denominator – Total no. of snake bite cases presented early or late ASV reaction
3c. Outcome	Proportion of patients developed ASV reactions out of total no. of total no. of patients provided ASV therapy Numerator - Total no. of snakebite cases developed ASV reaction Denominator - Total no. of patients provided ASV therapy
4. What Quality Measure means for each audience	Service Provider – Ensure that required drugs are available and clinical staff have been trained for managing ASV reactions Health Administrators/ QA Officials – Monitor the reaction and find out the root cause. Give feed back to ASV manufacturers and service providers Patient/ Community - Do not insist for ASV therapy if sign and symptoms of envenomation are not confirmed by clinician
5. Data Source	Patients clinical records Adverse Drug Reactions (ADR) records
6. Definitions	ASV Reaction – Any major or minor reaction occurred due to hypersensitivity to one of the ingredient of ASV, impurity in the drug, contamination or due to unnecessary administration of ASV.

Quality Standard-9 - Staff Skills & Competence for Management of Snakebite	
1. Statement	Health care provider is competent and confident to manage snakebite cases
2. Rationale	Snake bite is a medical emergency requires prompt and skilled clinical intervention to save the life of victim. As most of the snakebite cases happen in rural area the skills required to manage such cases should be available at first point of care may be a Primary or Community Health Center.
3. Quality Measure	
3a. Structure	Evidence that formal training has been provided to the medical officers for management of snake bite cases Evidence that updated Standard Treatment Guidelines/Protocols are available with clinical care staff
3b. Outcome	Proportion of patients referred to higher facilities because of lack skills/ confidence in treating snakebite cases . Numerator - Total no. of snakebite referred to higher facilities because of lack skills/ confidence in treating snakebite cases . Denominator - Total no. of suspected snake received in facility.
4. What Quality Measure means for each audience	Service Provider – Ensure that clinical care staff is training and STG on management of snakebite is readily available Health Administrators/ QA Officials – Conduct periodic skill assessment of the Medical officers and arrange for their trainings Publish and Distribute the guidelines on snake bite to all stakeholders
5. Data Source	Training Records Referral Register
6. Definitions	

Quality Standard-10 - Promotion of Scientific Management of Snakebite in community	
1. Statement	Health facility promotes the information and education regarding scientific management of snakebite in community
2. Rationale	There are several myths and traditional methods of managing snakebite prevalent in different part of India eg. Tying tourniquets, scarification, Ojha etc. None of this method are clinically proven effective. Due misbelieves and lack of information many of the victim still indulge these remedies which leads wastage of precious time and poor prognosis. Public Health system and service providers should educate the community regarding how to prevent snakebites as well as do's and don'ts incase of snake bite.
3. Quality Measure	
3a. Structure	Evidence that IEC material has been displayed at health facilities and public places regarding prevention and first aid in case of snake bite specially in endemic areas.
3b. Outcome	Proportion of snakebite patients attended, those have already gone through some traditional therapy or malpractice like trying tourniquets before reaching health care facility Numerator - Total no. snakebite patients received traditional remedy before reaching the healthcare facility Denominator - Total no. of Snakebite patients attended at Facility
4. What Quality Measure means for each audience	Service Provider – Promote health education on snakebite to patients and visitors in hospital through IEC display and counseling. Health Administrators/ QA Officials – Plan and implement health campaigns on prevention of snakebite and first aid. Patients & Community – Understand do's and don'ts in case of snakebite. Follow the preventive measures to avoid snakebites such avoiding sleeping on floor, open defecation, confronting with snake etc.
5. Data Source	Community and Health Care facility survey
6. Definitions	IEC – Information, Education and Communication